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BAY OF BENGAL PILOT

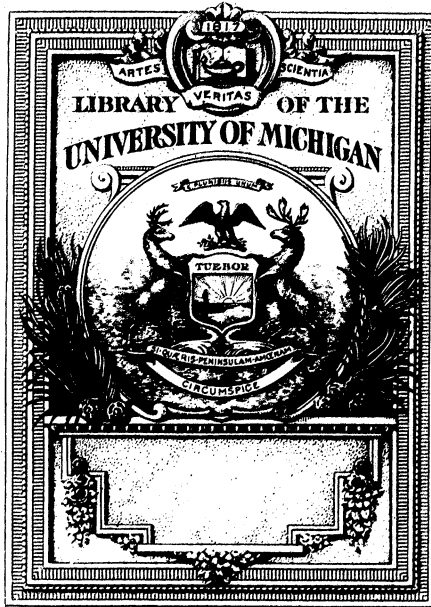
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THE
BAY OF BENGAL PILOT,
INCLUDING
SOUTH-WEST COAST OF CEYLON,
NORTH COAST OF SUMATRA,
NICOBAR, AND ANDAMAN ISLANDS.

COMPILED FROM VARIOUS AUTHORITIES.

SECOND EDITION.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

LONDON :
PRINTED FOR THE HYDROGRAPHIC OFFICE, ADMIRALTY :
AND SOLD BY
J. D. POTTER, AGENT FOR THE SALE OF ADMIRALTY CHARTS,
31 POULTRY, AND 11 KING STREET, TOWER HILL.
1892.

Price Four Shillings and Sixpence.

ADVERTISEMENT.

The Bay of Bengal Pilot contains Sailing Directions for the bay of Bengal and the adjacent coasts of Hindustán, Burma and Siam, together with Ceylon, the Nicobar, and Andaman islands, and the north coast of Sumatra ; commencing at Colombo on the west, and ending, on the east, at Junkseylon.

The information has been chiefly derived from the surveys conducted by the Officers of the Indian Navy prior to 1863, and by the Officers of the Marine Survey of India since 1874.

The first edition of the Bay of Bengal Pilot was compiled by Commander L. S. Dawson, R.N., and prepared for the Press by Lieutenant W. S. White, R.N., of the Hydrographic Office.

This edition has been revised by Staff-Commander W. N. Goalen, R.N., of the Hydrographic Office, who has incorporated the latest information furnished by the Officers of the Marine Survey of India, 1887 to 1891 ; and re-written the general account of winds, weather, climate, and cyclones, from the work on those subjects, by H. F. Blandford, F.R.S., published in 1889.

Where the Bay of Bengal Pilot overlaps the West Coast of Hindustán Pilot and the China Sea Directory, Volume I., the publication bearing the latest date should be taken as the best authority when any differences occur.

By the publication of this work, all Hydrographic Notices relating to the bay of Bengal series, as also all Notices to Mariners inclusive of No. 267 of 1892 are cancelled.

W. J. L. W.

Hydrographic Office, Admiralty, London,
August, 1892.

ORTHOGRAPHY.

As far as has been found possible,* the native names in this book are spelt in accordance with the following system, which will gradually be introduced into all Admiralty Sailing Directions. Where native names have been so long written in a form, which, though not in accordance with this system, has become familiar to English eyes from being so spelt in all charts and maps, they are retained, and no European names are changed from their correct orthography.† Information as to the proper spelling of native names so as to produce the nearest approximation to the true sound, by this system, is invited, but it must be remembered that only an approximation is aimed at. The position of the accent denoting the syllable on which emphasis, or the “stress” should be laid, is very important, as the sound of so many words is utterly changed by its misplacement.

Letters.	Pronunciation and Remarks.	Examples.
a	<i>ah</i> , <i>a</i> as in <i>father</i> - - - - -	Java, Somáli,
e	<i>eh</i> , <i>e</i> as in <i>benefit</i> ; <i>a</i> , as in <i>fate</i> - - - - -	Banána, Bari. Tel el Kebir, Oléleh, Yezo, Levúka, Peru.
i	English <i>e</i> ; <i>i</i> as in <i>ravine</i> ; the sound of <i>ee</i> as in <i>beet</i> . Thus, not <i>Feejee</i> , but	Fiji, Hindi.
o	<i>o</i> as in <i>mote</i> - - - - -	Tokyo.
u	long <i>u</i> as in <i>flute</i> ; the sound of <i>oo</i> in <i>boot</i> ; <i>oo</i> or <i>ou</i> should never be employed for this sound. Thus, not <i>Zooloo</i> or <i>Zoulou</i> , but	Zulu, Sumatra.
	All vowels are shortened in sound by doubling the following consonant.	Yarra, Tanna, Mecca, Jidda, Bonny.†
	Doubling of a vowel is only necessary where there is a distinct repetition of the single sound.	Nuúlúá.
ai	English <i>i</i> as in <i>ice</i> - - - - -	Shanghai.
au	<i>ow</i> as in <i>how</i> - - - - - thus, not <i>Foochow</i> , but	Fuchau.
ao	is slightly different from above - - - - -	Macao.
ei	is the sound of the two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from <i>ey</i> in the English <i>they</i> .	Beirút, Beilul.

* The spelling of Indian names has been largely taken from Hunter's Imperial Gazetteer of India. The form of spelling for places on the Burma coast is, in most instances, in accordance with the system adopted in “Tables for the Transliteration of Burmese into English,” published in Rangoon, 1884; this system appears very similar to that adopted by the Admiralty.

† The *y* in Bonny is retained as an example of this rule.

Letters.	Pronunciation and Remarks.	Examples.
b	English <i>b</i> .	
c	is always soft, but is so nearly the sound of <i>s</i> that it should be seldom used. If <i>Celébes</i> were not already recognised it would be written <i>Selébes</i> .	Celébes.
ch	is always soft as in <i>church</i> - - - - -	Chingchin.
d	English <i>d</i> .	
f	English <i>f</i> . <i>ph</i> should not be used for the sound of <i>f</i> . Thus, not <i>Haiphong</i> , but	Haifong, Nafa.
g	is always hard. (Soft <i>g</i> is given by <i>j</i>) - - - - -	Galápagos.
h	is always pronounced when used.	
hw	as in <i>what</i> ; better rendered by <i>hw</i> than <i>wh</i> , or <i>h</i> followed by a vowel. Thus, <i>Hwang ho</i> , not <i>Whang ho</i> and <i>Hoang ho</i> .	Hwang ho, Ngau hwi.
j	English <i>j</i> . <i>Dj</i> should never be put for this sound -	Japan, Jinchuen.
k	English <i>k</i> . It should always be put for the hard <i>c</i> . Thus, not <i>Corea</i> , but	Korea.
kh	The Oriental guttural - - - - -	Khan.
gh	is another guttural, as in the Turkish - - - - -	Dagh, Ghazi.
l	{ As in English.	
m		
n		
ng		
	has two separate sounds—the one hard, as in the English word <i>finger</i> , the other as in <i>singer</i> . As these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.	
p	As in English.	
ph	As in <i>loophole</i> - - - - -	Chemulpho, Mokpho.
th	stands both for its sound in <i>thing</i> , and as in <i>this</i> . The former is most common.	Bethlehem.
q	should never be employed; the sound of <i>qu</i> in quiver is given as <i>kw</i> . When <i>qu</i> has the sound of <i>k</i> , as in <i>quoit</i> , it should be given by <i>k</i>	Kwangtung.
r	As in English.	
s	As in <i>sin</i> .	
sh	{ As in English.	
t		
v		
w		Sawákin.
x	- - - - -	
y	is always a consonant, as in <i>yard</i> , and therefore should never be used as a terminal, <i>i</i> or <i>e</i> being substituted. Thus, not <i>Mikindány</i> , but nor <i>Kwaly</i> , but	Kikuyu. Mikindáni. Kwale.
z	English <i>z</i> - - - - -	Zulu.
zh	the French <i>j</i> , or as <i>s</i> in <i>treasure</i> - - - - -	Muzhdaha.
	Accents should not generally be used, but where there is a very decided emphatic syllable, which alters the sound of the word, it should be marked by an <i>acute</i> accent.	Tongatábu. Galápagos. Paláwan.

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**IN THIS WORK THE BEARINGS ARE ALL MAGNETIC,
EXCEPT WHERE MARKED AS TRUE.**

**THE DISTANCES ARE EXPRESSED IN SEA MILES OF
60 TO A DEGREE OF LATITUDE.**

**A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO
100 FATHOMS.**

**THE SOUNDINGS ARE REDUCED TO LOW WATER OF
ORDINARY SPRING TIDES.**

By transfer

1916

INFORMATION RELATING TO CHARTS, SAILING DIRECTIONS, AND THE GENERAL NAVIGATION OF H.M. SHIPS.

ON THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

THERE are three descriptions of publications as guides to navigation—the charts, the sailing directions, and the light lists—which are all affected by the continual changes and alterations that take place.

Of these the charts should always be, so far as our knowledge permits, absolutely correct to date ; and the light lists should be noted for the recent alterations, though space will not permit of full details being always inserted ; the sailing directions, however, cannot, from their nature, be so corrected, and *in all cases where they differ from charts, the charts must be taken as the guide.*

Charts.—When issued to a ship on commissioning, the charts have received all necessary corrections to date. As sent from the Hydrographic Office they are, as a rule, fresh from the plates. They then receive such corrections by hand in the dépôts as are required, and are so issued to the ships.

All small but important corrections that can be made by hand are notified by Notices to Mariners, and should at once be placed on the charts to which they refer.

Large corrections that cannot be conveniently thus made are put upon the plates, and fresh copies are issued to the ships to replace the others, which are directed to be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which these large corrections are made are noted on the chart plates in the middle of the lower edge ; those of the smaller corrections at the left-hand lower corners.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart, (which will be found in the lower right hand corner,) in order that at the Admiralty it may be known what edition of the chart is referred to.

The Light Lists, annually published at the beginning of each year, are not corrected in the dépôts before issue, but appendices are issued every two months, giving the alterations that have taken place, copies of which are put into the chart boxes.

It is the duty of the navigating officer when he receives the set of charts to make notations in the light lists from these appendices, and from the Notices to Mariners in the box ; and to keep them so corrected from time to time.

The Light Lists should always be consulted as to the details of a light, as the description in the Sailing Directions may be obsolete, in consequence of changes made since publication.

The Sailing Directions are not corrected before issue, except occasionally for very important new rocks or dangers. Hydrographic Notices and Supplements referring to each volume are published from time to time.

Supplements contain all the information received up to date since the publication of the volume to which they refer, and cancel all previous Hydrographic Notices.

Hydrographic Notices contain all information up to date since the publication of the volume, or since the last Supplement or Hydrographic Notice, but endeavour is made to issue no more than one of these affecting each volume, and, on the collection of fresh information, to include the former Notice in a Supplement.

The existence of Supplement or Hydrographic Notices is to be noted, in the tabulated form now being placed for the purpose inside the cover of each volume, in cases when such notations have not been made before issue, and also on receipt of further Notices after commission.

Notes should be made in the margin of the volume of sailing directions affected, as references to the Supplements or Hydrographic Notices when the latter are printed on both sides.

To enable the books to be more conveniently corrected, however, such Supplements and Hydrographic Notices as are of moderate size are now being printed on one side only, and two copies are issued to each ship ; one to cut up, the slips being pasted in at the appropriate place ; the other to retain intact for reference.

To make these notations or paste in these slips is one of the early duties of a navigating officer after drawing his box of charts and

books, and similar notes are to be made from Notices to Mariners that may thereafter be received.

It must, however, be thoroughly understood that sailing directions will never be correct in all details, except up to the date of the last Hydrographic Notice or Supplement. and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide; for which purpose, for ordinary navigation, they are sufficient.

THE USE OF CHARTS AS NAVIGATIONAL AIDS.

Accuracy of a Chart.—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger is the scale of the chart.

To estimate this, the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fulness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch.

A wide berth should therefore be given to every rocky shore or patch, **and this rule should be invariably followed, viz., that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.**

Fathom Lines a Caution.—Except in plans of harbours that have been surveyed in detail, the five-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for such a detailed survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, another warning, especially for ships of heavy draught.

Charts where no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed round, as there is no knowing how closely the spot may have been examined.

Chart on largest scale always to be used.—It sometimes happens that, from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive rearrangement of coastline or soundings. This is an additional reason, besides the obvious one of the greater detail shown on a larger scale chart, why this largest scale chart should always be used for navigating.

Caution in using small Scale Charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. This is particularly to be observed when coming to an anchor on a narrow ledge of convenient depth at some distance from the shore.

For the same reason bearings to objects near should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

Distortion of Printed Charts.—The paper on which charts are printed has to be damped. On drying distortion takes place, from the

inequalities in the paper, which greatly varies with different paper and the amount of the original damping; but it does not affect navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

Buoys.—It is manifestly impossible that any reliance can be placed on buoys always maintaining their exact position. Buoys should therefore be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings or angles of fixed objects on shore and not by buoys.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table of distances visible due to height, at end of each Light List, affords a means of ascertaining how much more or less the light is visible should the height of the bridge be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the standard compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its order, as given in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus, a light standing 200 feet above the sea and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of any power. (*See table in Light List above-mentioned.*)

Fog Signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from wind, large areas of silence have been found in different directions and at different distances from the origin of a sound, even in clear weather. Therefore too

much confidence should not be felt in hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly towards the land, and is not observed by the people at a lighthouse until it is upon them ; whereas a ship may have been for many hours in it, and approaching the land. In such a case no signal may be sounded. When sound has to travel against the wind, it may be thrown upwards ; in such a case, a man aloft might hear it when it is inaudible on deck.

Taken together, these facts should induce the utmost caution in closing the land in fogs. The lead is generally the only safe guide.

Tides and Tidal Streams.—In navigating coasts where the tidal range is considerable, caution is always necessary. It should be remembered that there are indraughts to all bays and bights, although the general run of the stream may be parallel to the shore.

The turn of the tidal stream off shore is seldom coincident with the time of high and low water on the shore. In open channels, the tidal stream ordinarily overruns the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half-tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

In crossing a bar or shallow flats, the table (B) at page 98 of the Tide Tables will be found of great assistance in calculating how much the water has risen or fallen at any hour of the tide.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can never be depended upon, and additional caution is necessary.

It should also be remembered that at times the tide falls below the level of low-water ordinary springs. This always occurs in temperate regions at the equinoxes, but wind may produce it at any time, and the amount varies with locality. When the moon's perigee coincides with the full or new moon the same effect is often produced.

Fixing Position.—The most accurate method of fixing a position relative to the shore is by angles between well-defined objects on the chart. All ships are now being supplied with a station pointer, and this method should be used whenever possible.

Two things are, however, necessary to its successful employment. First, that the objects be well chosen ; and second, that the observer is skilful and rapid in his use of the sextant.

For the former, reference can be had to the pamphlet on the use of the station pointer, which is in every chart box.

The latter is only to be obtained by practice.

It will readily be seen that in war time, when the compass may be knocked away, or rifle-fire may make it undesirable to expose the person more than necessary, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. It is this contingency that makes it especially desirable that all navigating officers should become expert in this method of fixing a ship's position.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

It is not intended that the use of the compass to fix the ship should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. In all cases where great accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. In the case of ordinary soundings, it is only necessary to take a third angle now and then; firstly, to check the general accuracy of the chart as above stated; secondly, to make certain that the more important soundings, as at the end of a line, are correctly placed.

Sometimes, when only two objects are visible, a compass bearing and sextant angle may be used with advantage.

In passing near a point of land, or an island, the method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "four-point bearing," when the bearing is taken four points on the bow, and on the beam, the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives an excellent fix for a departure, but does not ensure safety, as the point, and probably the rocks off it, are abeam before the position is obtained.

By taking the bearings of two points and four points on the bow, a very good position is obtained before the object is passed; the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current.

A table of factors, by which to multiply the distance run, to obtain the distance of the object when any number of degrees between the two bearings has been observed, is now supplied in all chart boxes.

The use of a danger angle in passing outlying rocks with land behind should also not be forgotten. In employing this method, however, caution is necessary, as should the chart be not accurate *i.e.*, should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

In fixing by the compass, it must always be remembered that two bearings only are liable to error. An absolute error may be made in either bearing observed; errors may be made in applying the deviation; or errors may creep in in laying them on to the chart. For these reasons, a third or check bearing of some other object should be taken, especially when near the shore or dangers. The coincidence of these three lines will prevent any mistakes.

In ships still fitted with the Admiralty standard compass, the tripod supplied to hold the lamp can be found of great service in fixing position at night, as by its aid a bearing can be as accurately taken as in daylight. Its use in connection with ascertaining the change of bearing of an approaching ship's light should not be forgotten.

Amongst astronomical methods of fixing a ship's position, attention is drawn to the great utility of Sumner's method. A Sumner line, that is, a line drawn through the position (obtained by an assumed latitude and longitude by chronometer) at right angles to the bearing of the sun, as obtained from the azimuth tables, gives at times invaluable information, as the ship must be somewhere on that line provided the chronometer is correct. A deep cast at the same time may often serve to get an approximate position on the line. An early and very accurate position can be also obtained by Sumner's method, by getting longitude by a bright star at daylight when the horizon is well visible, and another longitude by the sun when a few

degrees above the horizon or by observing two or more stars at twilight. The Sumner lines drawn through the two positions thus obtained will, if the bearing of sun and star differ three points or more, give an excellent result.

Current Arrows on charts only show the most usual or the mean direction of a tidal stream or current. It must never be assumed that the direction of a stream will not vary from that indicated by the arrow. In the same manner, the rate of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are re-engraved when the error amounts to a quarter of a point, but the chart plates cannot be corrected more frequently from the impossibility of making alterations too often on one spot in a copper plate.

The geographical change in ~~variation~~ variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles. The variation chart should be consulted on this head.

Local Magnetic Disturbance of the Compass on board Ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that disturbance of the compass in a ship afloat is experienced only in a few places on the globe.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together.

The law which has hitherto been found to hold good as regards local magnetic disturbance is, that north of the magnetic equator the north end of the compass needle is attracted towards any centre of disturbance ; south of the magnetic equator it is repelled.

It is very desirable that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

Use of Oil for Modifying the effect of Breaking Waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows :—

1. On free waves, *i.e.*, waves in deep water, the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain ; as nothing can prevent the larger waves from breaking under such circumstances ; but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use ; crude petroleum is serviceable when nothing else is obtainable ; but all animal and vegetable oils, such as waste oil from the engines, have great effect.
4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
5. It is useful in a ship or boat, both when running, or lying to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.

7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be : hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

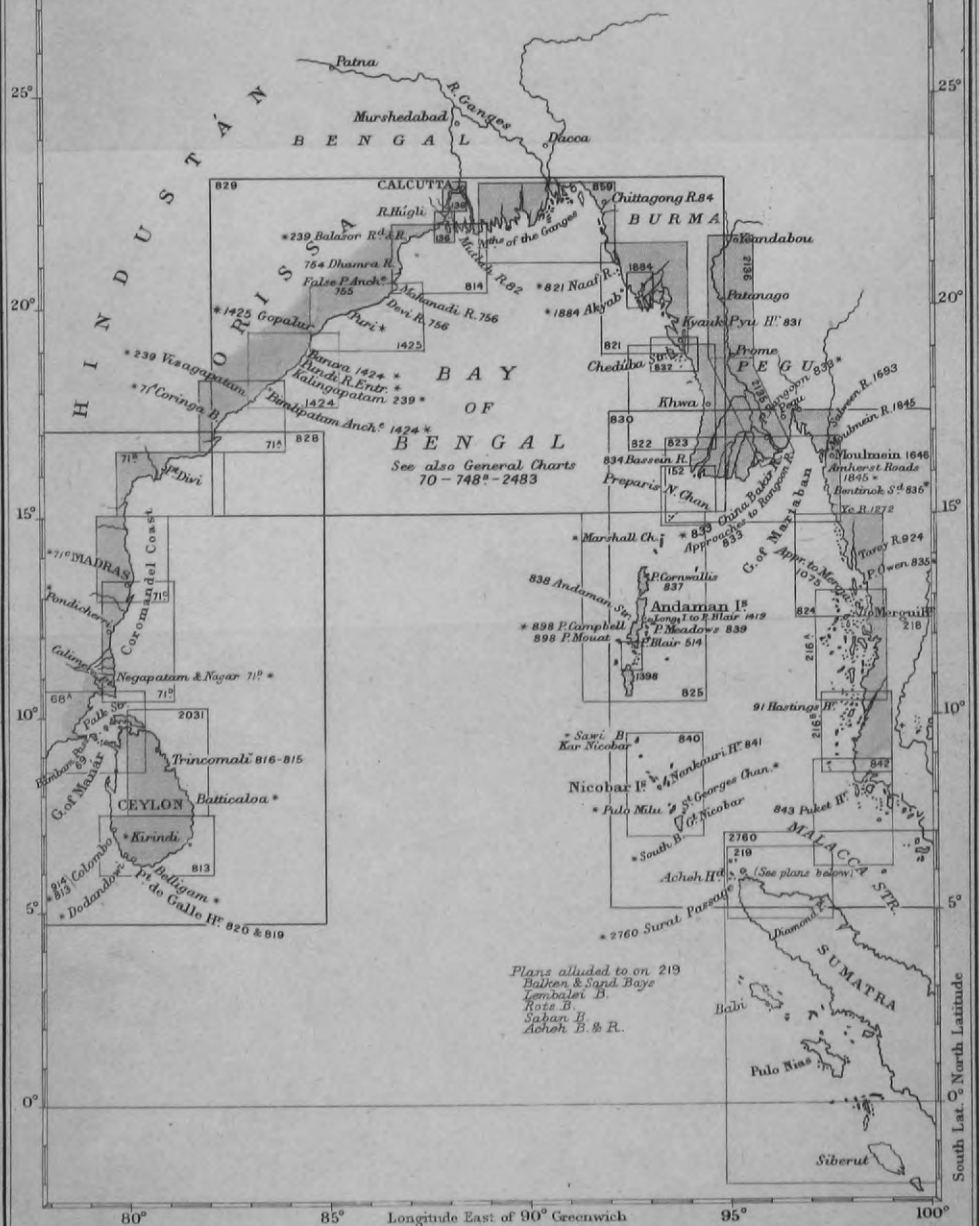
INDEX TO ADMIRALTY PUBLISHED CHARTS ALLUDED TO IN THIS WORK

* indicates that a plan is given upon the coast chart, which is shown by the diagram to embrace it.

* 71° indicates that a plan of the place against which it is written is given upon chart N° 71°

A number against the name of a place thus; Tavoy R. 924, shows that a separate plan is published bearing that number.

For details of scales, prices, &c. see Admiralty Catalogue.



Plans alluded to on 219
Balken & Sand Bay
Lembeh B.
Rota B.
Sabar B.
Acheh B. & R.

For later information respecting the lights which are described in this work, seamen should consult the Admiralty List of Lights, Part V.; South Africa, East Indies, China, &c. These Lists are published early in the current year, corrected to the preceding 31st December.

S O 11368

THE BAY OF BENGAL PILOT.

CHAPTER I.

GENERAL REMARKS. CEYLON, MADRAS, BENGAL, BURMA, ANDAMAN AND NICOBAR ISLANDS. COMMUNICATION. DOCKS. COAL. WINDS. BAROMETER. CYCLONES. CURRENTS. SOUNDINGS. UNIFORM SYSTEM OF BUOYAGE. PASSAGES.

GENERAL REMARKS.—The bay of Bengal,* so called from the Indian province situated on its northern side, the name of which is derived from Banga,† the Sanskrit term for that part of the country, is a considerable gulf of the Indian ocean, triangular shaped, comprised between the parallels of 8° and 20° N. latitude, and the meridians of 80° and 98° E. longitude. It is bordered on the east by the coasts of Arakan, Pegu, Tenasserim, and part of the Malay peninsula, while on its western shore, southward of Bengal, stretch the Orissa and Coromandel coasts, the indentation known as Palk bay (so named from the Dutch governor who first navigated it), and the east coast of the island of Ceylon. Between Chittagong on the east, and Balasor on the west, at its head, the bay of Bengal is about 275 miles in breadth, whereas the distance across its mouth, from the Malay peninsula to cape Comorin, is about 1,200 miles; or, if measured between the south point of Ceylon and the north point of Sumatra, about 880 miles.

The Venetians were the first Europeans trading with India proper, before the discovery of the passage to it round the cape of Good Hope in 1497. The Portuguese then commenced their trading visits to India. In December 1600, the charter was granted, from which originated the British East India Company. The first English factory was established in 1622 at Masulipatam. In 1634 the English

* See Admiralty charts:—Indian ocean, northern part, No. 7486; and bay of Bengal No. 70.

† The term "Banga" applies, strictly speaking, to the country stretching south-east from Bhagalpur to the sea.

obtained the privilege of free resort to the port of Pippli in Bengal, situated near the mouth of the Subarnarekha river. The first settlement on the Húgli was built at the village of Húgli, about 26 miles further up the river of that name than the Calcutta of to-day. In 1686, the seat of Government was removed to the present locality.

There are no first class coast harbours on the shores of the bay of Bengal, with the exception of Trincomalí, a land-locked arm of the sea, situated on the east coast of Ceylon ; but at Madras, on the Coromandel coast, engineering efforts have succeeded in enclosing by means of breakwaters, a harbour to afford shelter from the constant heavy surf, as well as the cyclones which occasionally sweep over this locality in common with other parts of the bay. The river ports, Calcutta on the Húgli, and Chittagong on the Karnafuli, in Bengal, are, however, much frequented ; as also are those of Akyab, Bassein, and Rangoon ; and in a lesser degree, Moulmein, situated some 80 miles eastward of Rangoon, on the Salween river. Port Blair in the Andaman islands is an excellent harbour.

GENERAL DESCRIPTION.—Of the provinces which border the bay of Bengal, the whole are under British rule, with the exception of the territory southward of Pakchan river, in the Malay peninsula, which is part of the kingdom of Siam ; and the small French colonies of Pondicherri, Karikal and Yanaon, on the western shore of the bay.

CEYLON,† known as Lanka to the natives of India, but called Serendib by the Arabs, is situated at the south-east extremity of the peninsula of Hindustán.

This island was visited in early days by Greeks, Romans, and Venetians ; the first European settlements were formed by the Portuguese in 1505 ; in the next century they were dispossessed by the Dutch. Ceylon passed to Great Britain in 1796, and became a Crown Colony in 1801, but the whole of the interior did not acknowledge British rule until the year 1815.

It is still a Colony independent of the Indian Government.

The extreme length of Ceylon, north and south, is 240 miles, and its greatest breadth, on the parallel of Colombo, is 120 miles. The northern part of the island is low and flat, but the southern is mostly high mountain region, separated from the nearest or Western Gháts of India by a gap of 200 miles. The west coast of Ceylon is low, and planted with cocoa-nut and other trees. The south and east coasts

† The Portuguese speak of Ceylon as Celan. To the Greeks and Romans it was known as Taprobane.

are bold and rocky, and in many parts picturesque, especially where the mountains of the interior approach the coast, gentle declivities extending from their bases to the groves of cocoa-nut trees which fringe the level beach. The north and north-east coasts are flat, and indented with lagoons. The interior is mostly covered with forest.

Products.—About one-fifth of the island is under cultivation, the most important productions being rice, grain, coffee, tea, chinchona, cocoa-nuts, cinnamon, tobacco, areka and other palms, and cacao.

Ceylon is famous for precious stones, especially cats-eyes, sapphires and rubies. An extensive pearl fishery is carried on in the gulf of Manar. The natives work in gold, silver, ivory and tortoise-shell, pottery, mats, fans, and wood carving.

Population.—The population of Ceylon by the census of 1891 was 3,008,239 ; of whom nearly 70 per cent. were Sinhalese, and nearly 25 per cent. Tamils. The proportion of Europeans to natives is about 2 per thousand.

Climate.—The climate of Ceylon, especially in its south-west province, is essentially tropical ; but it is by no means the same in its several parts. The heavy rainfall of the summer monsoon is restricted to the south-west portion of the island, while the eastern side receives its most copious rainfall in November and December ; the rain of this latter season is not however confined to the east coast, it extends to the hills and to the south-west coast, where the average fall of October and November is as heavy as that of May, and heavier than it is there in the other months of the south-west monsoon. On the north-west coast opposite to India the rainfall is comparatively light, and the same on the south-east coast. Ceylon is seldom visited by cyclones, and the breeze is always more or less refreshing ; the heat in the plains is much less oppressive than in Hindustán. On the coast the annual mean temperature is about 80°. At Colombo, which may be said to represent the wettest part of Ceylon, the average annual rainfall is 87 inches, with a fall of 13 inches in October, 13 inches in May, and 2 inches in February, the mean daily temperature varying from 68° to 93°. At Trincomali, which may be said to represent the drier part of Ceylon, the annual rainfall is 62 inches, with a fall of 13 inches in December, and one inch in March, the mean daily temperature varying from 68° to 99°. On the south coast the mean daily temperature varies from 70° to 90°, and at the hill station Nuwara Eliya, 6,000 feet above the sea, the thermometer falls at night to freezing point. See also tables of

monthly temperature, barometer, rainfall, &c., at Colombo and Trincomali, with the descriptions of those ports.

Trade.—The principal exports are coffee, chinchona, and tea; other exports are cocoa-nut oil, kernels, coir and copra, cacao, cinnamon, cardamoms, citronella oil, plumbago, and tobacco. The exports are mainly sent to the United Kingdom, but some trade is carried on with India, the United States, France, Austria, and Australia. The imports are chiefly rice from India, and textiles and coal from the United Kingdom. The value of the exports in 1888 was 58,524,990 rupees, and of the imports 39,383,135 rupees.

Railways.—There are 180 miles of railway in Ceylon, all belonging to the Government. Colombo is connected with Kaltura, 28 miles to the southward; with Kandy, 74 miles eastward, and Matate 18 miles northward of Kandy; also with Nuwara Eliya and Nanu Oya, 58 miles southward of Peradeniya, a junction on the Colombo-Kandy line, a short distance southward of Kandy.

Telegraph.—There are upwards of 1,200 miles of telegraph lines open in Ceylon, and the principal towns are connected by it with one another, and with the telegraph system of India.

MADRAS.—With the exception of the small French settlements, Pondicherri Karikal and Yanaon, the whole of the western shore of the bay of Bengal, as far northward as the southern end of Chilka lake, in lat $19^{\circ} 30'$, is part of the province or Presidency of Madras. The first British settlement in this province was established in 1622 at Masulipatam; another factory was erected in 1625 at fort St. George, Armeghon; but Masulipatam was abandoned in 1628, and Armeghon in 1638; fort St. George, Madras, being founded in 1639. In 1683 the territory became an independent presidency; but it was small in extent until 1801, when the annexation of the Carnatic raised it to nearly its present dimensions.

The Coromandel coast extends from opposite Ceylon to about lat. 17° N., it is generally low and wooded near the sea. This is especially the case in the delta of the Coleroon (Kaveri river), which occupies a large area southward of Madras. The Eastern Ghats commence northward of the Kaveri valley, and extend parallel with the coast to the Blue mountains of Orissa. These Ghats approach nearest to the coast at about 30 miles westward of Pulicat, in lat. $13^{\circ} 30'$ N., where Kettle-bottom has an elevation of 2,824 feet. Between the Eastern Ghats and the coast the country consists of alluvial plains, with many streams, none of which are navigable by any but very

small vessels. At the northern end of the Coromandel coast, the Kistna and Godavari rivers discharge their waters into the bay, after traversing nearly the entire breadth of the Hindustán peninsula. Their deltas have formed two rounded areas projecting some distance from the general line of coast, and so low that they are liable to inundation from cyclone waves. Gigantic systems of irrigation are connected with the Godávári, Kistna and Kaveri rivers, and their deltas are traversed by networks of canals.

Northward of the Godávári river, the Orissa coast begins, and the mountains approach the shores of the bay up to the south end of the Chilka lake. The coast runs in a curve to the north-eastward without indentations. The geological formation of the mountain region of Madras is basaltic, and that of the plains bordering the sea mostly laterite.

Products.—The chief production of the Madras province is rice; sugar, tobacco, indigo, cotton, and oleaginous seeds are also largely grown. Cocoa-nuts grow along the whole extent of the Coromandel coast. Salt is obtained by evaporation from sea water. There are diamond fields in the Karnúl district of the Kistna valley. Vizagaptam is famed for its carved ivories encrusted with silver; Madapolam, in the Godávári delta, for a fine description of calico; and Puna, in the Kistna delta, for fancy wares. Hand-loom weaving is extensively carried on. There are about $7\frac{1}{2}$ millions of horned cattle in the province, nearly 5 millions of sheep, and 3 millions of goats.

Population.—The population of the Madras province by the census of 1891, was 35,588,850, of whom 92 per cent. were Hindus, and 6 per cent. Muhammedans. The delta of the Kaveri is the most thickly populated part of the province. The natives are Dravidians, those in the south speaking the Tamil, and in the north the Telugu tongues of that language.

Climate.—The climate of the coast plain of Madras differs in many important respects from that of the other parts of India. The dry season lasts from the middle of December to the latter part of June, but in April and May there are usually little storms, locally known as mango showers, which give on the plains an average of 3 to 5 inches of rain in the two months. The rainfall of June is lighter than that of May. That of the whole summer monsoon from June to October is light, amounting to 4 or 5 inches a month in July, August and September; heavier rain sets in during October and lasts until December.

There is no season that can be called cool in a European sense, otherwise than comparatively. For about six weeks after the cessation of the December rains, the winds are northerly, the nights pleasant, and the heat of the day not excessive. In the spring months hot land winds sometimes blow, but at the city of Madras and other places on the coast April is the season of the longshore winds, which, though cooler than the land winds, are damp and very relaxing.

Heavy rains may fall in May if a cyclone passes over the locality. The average annual rainfall from Pulicat to Calimere point, to a distance of 10 to 20 miles inland, exceeds 40 inches; northward of Pulicat lake it is about 20 inches.

Madras and Masulipatam may be taken as representing the aspects of the coast climate. The mean temperature of Madras is 81° ; that of December and January 76° , and of June 88° . In January the early morning readings average 68° . The highest readings, 102° to 113° , have been recorded with the land winds in May. The driest month is June, with a mean humidity of 61; the least rainfall, a quarter of an inch, is in February. The wettest month is November, with a mean humidity of 79; and it also has the greatest rainfall, nearly 14 inches. The mean annual rainfall is nearly 50 inches. The mean annual range of temperature is 48° .

At Masulipatam the mean temperature is 81° ; that of December and January 74° , and that of May, the hottest month, 88° . In no month does the afternoon maximum average less than 83° , or the average night minimum less than 66° . The highest readings vary between 101° and 116° , the lowest between 58° and 62° . The air is driest in June when the humidity is 67, and dampest in October and November, when it is 78. The mean rainfall of the year is about 38 inches, of which only $1\frac{1}{2}$ inches fall from December to April; most rain falls in October, $8\frac{1}{2}$ inches. The mean annual range of temperature is 50° . See also tables of monthly temperature, rainfall, barometer, &c., at Madras and Masulipatam, with the description of those ports.

Trade.—The exports from Madras province in 1889–90 were valued at 116,085,090 rupees; and the imports at 64,374,210 rupees.

Railways.—The Madras N.W. railway joins the Great Indian Peninsula system at Raichur, thus connecting Madras with Bombay and Calcutta. A railway is constructing from Bezwada to meet N.W. Madras railway at Gunkal; and another line from Nellore to meet that railway at Tirupati. The Madras S.W. railway runs from Madras to Beypur on the west coast of Hindustán, with branches to

Bangalore, Mysore, and Bellary. A line is in course of construction from Bangalore north-westward to Goa, which when completed will give an alternative route from Madras to Bombay. The South Indian system extends southward from Madras, connecting that city with Tuticorin, Trichinopoli, Tanjore, and Tinneveli; also Pondicherri, Cuddalore, Porto Novo, Coleroon, and Negapatam are connected by this route.

BENGAL.—The coast of Bengal commences at the south end of Chilka lake, the north extreme of Madras, and extends round the head of the bay and down the east shore as far as the mouth of the Naaf river in lat. $20^{\circ} 45'$ N. The first English factory on the coast of Bengal was founded at the mouth of the Subarnarekha river, about 35 miles westward of the entrance to the Húgli, in 1634; and the first settlement on the Húgli, at Húgli, in 1642. The seat of Government was transferred to Calcutta in 1686, which remains the capital of the Indian Empire to this day.

The coast of Bengal is principally occupied by the delta of the river systems of the Mahanadi, with the Brahmani and Baitarani; and that of the combined Ganges and Brahmaputra.

The Mahanadi rises in Central India and pierces the Eastern ghats at Barmul pass, where in flood time it sometimes rises 65 feet above its winter level. In its delta it unites with the Baitarani and Brahmani rivers, the alluvium from the three rivers forming the coast from Chilka lake to Balasor road, a distance of nearly 150 miles. An immense system of irrigation and embanking has been carried out in this delta, and this has rendered it less liable than it formerly was to inundation from the river waters or from cyclone waves, which left behind them the probabilities of famine.

The delta of the Ganges and Brahmaputra rivers forms the entire shore at the head of the bay of Bengal, from the eastern part of Balasor road to Chittagong, a distance of 250 miles.

The Ganges enters the plains at the foot of the Himalayas at Hardwar, 1,000 feet above the sea level; where five-sixths of its mean discharge is diverted to the navigable and irrigation canal, the finest work of the kind in existence, which after having irrigated an area of 7,000 square miles, joins the Ganges again at Cawnpore. After being swelled in its easterly course by many tributaries, the Ganges reaches the head of the delta about 17 miles south of Gaur, and 210 miles from the sea. The main branch winds south-eastward to its junction with the Brahmaputra, and enters the bay of Bengal as the Meghna. The secondary branch, the Bhagirati, formerly the

main stream, flows into the sea as the Húgli. By constant care and attention the channel of this river as far as Calcutta is maintained as the best navigable waterway of all the mouths of the Ganges.

Between the two branches the country is intersected by numerous streams, which continually shift their beds and even their names. The southern part of this delta is a sort of neutral zone between land and water, connected with *terra firma* by its vegetation, and with the sea by the liquid masses everywhere penetrating through it; it is known as the Sundarbans, and is a vast labyrinth, its many channels mostly accessible only to boats. Some of the islands in it are covered with dense forests, others produce only dwarf palms or brushwood, and all are the retreats of wild beasts. The area of cultivation of the Sundarbans is now increasing, especially near the Meghna, where many square miles have been reclaimed.

Eastward of the eastern mouth of the Meghna the Chittagong coast runs to the southward to the boundary of Bengal; this coast is low and bounded by sand and mud flats in its northern part, but becomes steep and cliffy to the southward. The district is occupied by the western slope of the hills between the Irrawaddy valley and the bay of Bengal; and is covered with dense forests, the jungle being infested by wild beasts.

Products.—Bengal is almost entirely an agricultural province; the principal production is rice; opium is cultivated in the Patna district; cotton north-westward of Calcutta and in Chittagong; tea on the Himalayan slopes, northward of Calcutta; and jute in the north-eastern parts of Bengal. Tobacco is grown in the Ganges basin, and wheat southward of the Ganges. Areca is grown in the deltas, and indigo principally in Tirhut. Chinchona is cultivated at Darjiling.

The chief manufacturing industry of Bengal is jute, its weaving into gunny cloth being a common pursuit throughout the northern part of the province. Calcutta supplies bagging for the whole of India. Salt is made in Orissa by evaporation from sea water. Saltpetre is manufactured in north-western Bengal. Patna is celebrated for its embroidered muslin. Cotton carpets are made chiefly in Bengal.

Coal.—The most extensively worked coal mines in India are at Raniganj, the coal-field having an estimated area of 500 square miles. The mines are connected with Calcutta by the East Indian railway,

the distance being about 120 miles. The coal is of rather poor quality, and contains much ash. The output is about half a million of tons per annum from this mine.

Population.—The population of Bengal in 1891 was 70,909,260 ; of whom 65 per cent. were Hindus and 30 per cent. Muhammedans. This province is the most densely populated in India, having in its inhabited parts an average of nearly 400 persons to the square mile. The natives are of Aryan, Dravidian, and Kolarian races.

Climate.—The climate of Bengal is generally damp and relaxing ; there are three seasons in the year, usually called the cool, the hot, and the rainy. The cool season lasts from the middle of November to the middle of February, for 10 or 12 weeks of which period the weather is delightful, but the dampness of the climate manifests itself at night in frequent fogs on the rivers and low grounds. Usually no rain falls in December ; in January and February 2 or 3 rainy days occur, preceded by close cloudy weather with light southerly winds ; after such rains there is a renewal of the cool season.

Towards the end of February the temperature begins to rise, and damp winds from the bay commence on the coast. In March and April the increase in temperature is rapid, and during the afternoons of the latter month the thermometer sometimes rises to its highest annual temperature ; in these months rain falls in greater quantities than before, mostly in the shape of thunder squalls known as *nor'-westers*, which as a rule come on towards evening, and are often preceded by a dust storm. The effects of the hot season at Calcutta are mitigated by the cool southerly wind, which generally blows up the estuary of the Húgli at the close of the day, and lasts until midnight. Dry westerly winds are felt occasionally in the spring months, but even they are reduced in temperature and rendered less parching by the moisture taken up from the surface over which they pass.

In the first or second week in June the continuous rains begin with the burst of the monsoon ; the immediate effect of which is a great fall in the day temperature. As long as the rainfall is abundant and nearly continuous the climate is not very unhealthy or oppressive. In September the rainless intervals become longer and the day temperature begins to rise, while the air, still highly charged with moisture, is almost motionless ; consequently this month and October are the most trying and unhealthy. The hot season is also trying to Europeans owing to the moisture in

the air. An appreciable fall in temperature takes place early in November, and brings a feeling of relief.

The mean temperature of Bengal is 77° to 78° ; in January it is 66° ; and in April and May 85° to 86° in the western districts, and 81° to 83° in the eastern. The highest temperatures usually occur in May, when they are 97° to 106° at Calcutta, and 91° to 99° at Chittagong. The average diurnal range of temperature on the coast is about 23° . In February and March, the driest months, the humidity at Calcutta is 69 per cent., and at Chittagong 70. At the height of the rains the average humidity is 87 per cent. in Bengal, and at Calcutta in August as much as 89.

The average annual rainfall at Calcutta is $65\frac{1}{2}$ inches, and at Chittagong 106 inches; the rainiest month at the former place is August when nearly 14 inches fall, and at the latter June when the fall averages nearly 24 inches. *See also*, tables of monthly temperature, rainfall, barometer, &c., at Cuttack, Calcutta and Chittagong, with the descriptions of those ports.

Trade.—The imports into Bengal in 1890–91 were valued at Rs. 260,803,178; and the exports at Rs. 372,592,676.

Railways.—Calcutta is connected by railway with Diamond harbour on the Húgli, and with Mutlah (Canning Town) on the Mutlah river, but with no other ports in Bengal. The East Bengal railway runs from Calcutta northward to Darjiling; the East Indian, north-westward, connecting at Allahabad with the Great Indian Peninsula system, thus giving continuous railway communication with Bombay and Madras. The furthest point north-westward connected by railway with Calcutta is Peshawar, at the entrance to the Khyber pass; and westward, the furthest point is Karachi.

BURMA.—The coast of Burma adjoins that of Bengal at the mouth of the Naaf river, and forms the east shore of the bay of Bengal, as far south as the mouth of the Pakchan river in lat. 10° N. Arakan, the northern part, and Tenasserim, the southern part, were annexed by the British after the first Burmese war in 1826; and Pegu, which includes the delta of the Irrawaddy, after the second Burmese war in 1852.

In Burma the mountain ranges have a general north and south direction, running in lines parallel to the coast. Eastward of Arakan the main range is called Yoma, and attains heights upwards of 8,000 feet above sea level between lats. 21° and 22° N.; this range terminates at cape Negrais, gradually nearing the coast and declining in height towards that point. Between Naaf river and Ramree

island the coast is much cut up by various rivers running from the mountains lying to the eastward, and is generally low, with off-lying dangers. Akyab is connected with many of these streams by more or less navigable channels. The geological formations of the Arakan coast consist of limestone and sandstone of the chalk and tertiary epochs, with some igneous rocks, but no true volcanoes. The cones of this coast are mud volcanoes, of which there are 40 in the archipelago southward of Combermere bay. At the north end of Ramree island there are 6 of these cones, each rising to a height of 40 feet; they display great energy every alternate year or oftener, ejecting mud, inflammable gases and stones. These phenomena are occasionally accompanied by earthquakes, but no true lavas are ever thrown up by the craters of Ramree and Cheduba. Petroleum springs bubble up in the neighbourhood of the cones, and the oil even flows from fissures in their sides. Between Cheduba and cape Negrais the coast is higher than to the northward, still with scattered off-lying islets and rocks.

The Irrawaddy river drains the whole of north-west Burma, and enters the gulf of Martaban, eastward of cape Negrais, by fourteen mouths. Its delta is a vast alluvial plain; the first fork from the main river branching off nearly 130 miles from the sea. The eastern and western branches are the principal navigable waterways, Rangoon being situated on the eastern and Bassein on the western branch. This delta, subject to inundations, is steadily advancing seaward. The Irrawaddy delta is separated from the Sittang delta by the Pegu Yoma range; further eastward the Salween river discharges its waters past Moulmein. A network of channels and backwaters occupies the deltas of the Sittang and Salween, and in the rainy season this part of the coast is converted into a vast lake.

The Malay peninsula is a southern extension of the mountains separating the Salween and Menam river basins; the ranges run north and south, and are clothed with a dense forest vegetation. The coast is generally high; it is fringed for 200 miles by the islands of the Mergui archipelago, the scattered fragments of partly submerged ranges, disposed in several chains parallel to the axis of the peninsula, and consisting of the same granite, porphyry, and conglomerate formations.

Products.—The chief productions of Burma are rice, teak from forests, sugarcane, tobacco, cotton, gingelly, and many tropical fruits. Tea is grown in Arakan. Of minerals tin is the most important; but gold, silver, precious stones, iron, and lead are also found.

Population.—The population of Lower Burma in 1891 was 4,569,170, of whom 88 per cent. were Budhists, 2 per cent. Hindus, 4 per cent. Muhammedans, and 2 per cent. Christians. The natives have probably all sprung from the same ethnical stock. Besides the Burmesé, Karens occupy the mountains, and the rude fishing community of Silongs live during the south-west monsoon on the islands of the Mergui archipelago. The estimated population of Upper Burma is about 3,000,000.

Climate.—The exposure of the hill ranges on the coast of Burma to the south-west monsoon causes an excessive rainfall from June to September, and as the southerly monsoon continues to blow in the eastern half of the bay of Bengal for some weeks after it has ceased in the western half, the stormy weather of October and first part of November brings much rain to this coast also. The Irrawaddy, Sittang and Salween deltas share the heavy rainfall, but as the Irrawaddy valley is ascended the climate becomes drier. In the winter months the winds are light from the northward on the coast, and north-east in the Irrawaddy delta. In January the wind shifts to north-west, and through west to south-west later on. The south-west monsoon blows up the Irrawaddy valley as a southerly wind. From December to April little rain falls, except in the southern parts of Tenasserim. In May rains become more frequent, and during the four following months a rainless day is rare on the coast of Burma. During this season the air is saturated with moisture, but the temperature is moderate on the coast; at Rangoon and Moulmein it has a maximum of 83° to 85° in the day and a minimum of 74° to 76° at night. Higher up the Irrawaddy valley at Mandalay the temperature in the rainy season occasionally reaches 100°. The climate of Pegu is notoriously unhealthy, and this is most likely due to the damp atmosphere, and the great changes of temperature which take place within 24 hours.

The temperatures, humidity, and rainfall at Akyab, Rangoon, and Mergui will be given as representative of the coast climate. The annual mean temperature of Akyab is 79°, that of December, the coolest month, 69°; and of April and May, the hottest months, 84°. In July and August the mean temperature sinks to 81°. The maximum temperature recorded is less than 100°. In February the diurnal range averages 25°, but at the height of the rainy season it sinks to 7° or 8°. The mean humidity of Akyab is 80 per cent., falling to 70 in February, and rising to 89 in July and August. The average annual rainfall is 196 inches; very little falls from December

to March, the greatest fall taking place in July and August, during each of which months it is 50 inches.

At Rangoon the mean temperature is 79° , coolest in January 75° , and warmest in April 84° ; in the last month the afternoon maximum often exceeds 100° . When the rains begin in May the temperature falls quickly, and from June to September the mean is 78° to 79° . During the first four months of the year the diurnal range is 20° to 30° , while from June to September it is 9° . The mean humidity is 78 per cent., least in February when it is 62, and most in July and August, 90 to 91. The mean annual rainfall is a fraction less than 100 inches; less than one inch falls from December to March, the heaviest fall taking place in July when it is 21 inches. Moulmein, although comparatively near Rangoon, has an annual rainfall of 188 inches; an average of 40 inches falls in each month of July and August, when the humidity is almost complete saturation. Otherwise the climates of Rangoon and Moulmein are similar.

Mergui is remarkable for the equability of its temperature, its annual mean being 78° ; in the coolest months, July and December it is 76° , but the average maximum in July is 84° , and in December 88° ; in the hottest month, April, the mean is only 81° . The thermometer has not registered 100° since it has been observed at Mergui. The mean humidity is 82 per cent., and it is never less than 73 in any month, in August and September it is 90. The dry season is very short at Mergui, lasting only during December and January; the mean annual rainfall is about 160 inches, of which nearly 32 inches fall in July. *See* also tables of monthly temperature, rainfall, barometer, &c., at Akyab, Rangoon, Moulmein and Mergui, with the descriptions of those ports.

Trade.—In 1889–90 the Burmese imports were valued at Rs.54,677,520, and the exports at Rs.77,815,420.

Railways.—The only railways in Burma are those running up the Irrawaddy and Sittang valleys, connecting Rangoon with Prome, and with Mandalay; the former a distance of about 130 miles, and the latter about 400 miles.

ANDAMANS AND NICOBARS form a nearly continuous chain of islands on the east side of the bay of Bengal, between cape Negrais and Acheh head. The first penal settlements were founded by the British at port Cornwallis, North Andaman, in 1791 and 1795; but the site was found unhealthy and was abandoned. Port Blair, South Andaman, was established as the penal settlement in 1858. The Government of the islands is administered there by a Chief Commis-

sioner. The Andamans are a seaward continuation of the Arakan Yoma range, and of similar geological formation. They are divided by three shallow straits into four main sections, around which are grouped smaller islands, with Narkondam and Barren island lying some distance to the eastward. The last two islands are volcanic; but Narkondam is clothed with vegetation, and appears to be extinct; while Barren island has been quiescent since the beginning of the century. The Andamans are mountainous throughout, and clothed with a dense vegetation.

An elevation of 2,400 feet above the sea is attained in North Andaman at Saddle Hill, and Narkondam is less than 100 feet lower. Several extensive coral banks lie on the western side of the Andamans, and the shallow Invisible bank to the eastward. The harbour of port Blair is one of the finest places of refuge in the Indian ocean.

The first European settlement in the Nicobars was founded by the French Jesuits in 1711, but they were all killed by the natives. The Danes established themselves at Great Nicobar in 1755, and abandoned the colony after three years. In 1768 the German Moravians founded a station on Nankauri, and 10 years afterwards the Austrians occupied that island for a short time. Later on the Danes again attempted to colonise the archipelago, but finally abandoned it in 1845. The British had officially annexed the group in 1807, but did not occupy it until 1869, when a penal settlement was established at Nankauri harbour. The chief resident official is the Superintendent, the islands being attached to the Andamans for purposes of government.

The Nicobars comprise three groups, with some coral banks in the centre. They belong to an area of upheaval, and some of the hills appear to be of volcanic origin, but no lava has been found on them. The depth between the northern island of the group and Little Andaman is upwards of 600 fathoms, and between the southern island and Acheh head it exceeds 1,000 fathoms. The Nicobars are densely wooded, and in Great Nicobar attain an elevation of 2,105 feet at mount Thuillier. Nankauri harbour, between Kamorta and Nankauri, affords the only secure harbour in the group. Since the land has been cleared in that vicinity, the health of the inhabitants has considerably improved.

Products.—The Andamans produce much valuable timber, coffee, and rice, and nutmegs have been cultivated with much success. Pasturage for cattle has been obtained by clearing the jungle. The

Nicobars principally produce cocoanuts, the annual yield being about 15,000,000.

Note.—Any vessel wishing to trade at the Nicobars must obtain a permit at port Blair.

Population.—By the census of 1891, the population of port Blair was 15,670. The aborigines in the Andamans were then estimated to number 6,000. The population of the Nankauri settlement is about 450; and the natives on the Nicobars, Kar Nicobar having nearly half of them, are estimated to number 7,000.

The Andaman aborigines are commonly grouped with the Oceanic Negrito stock, but they show little resemblance to the negro type except in their dark complexions. Their dialects differ to such an extent that the inhabitants of the north are unintelligible to those of the south. They are everywhere friendly to Europeans, except at the south end of Little Andaman, but it is necessary to approach them with caution as they are easily frightened. *See* page 278.

The Nicobar aborigines are of an altogether different type to those of the Andamans. They are said to resemble the Butans of Formosa more than other people, and are classed by some as Malays, and by others regarded as half-cast Indo-Chinese. The skull is artificially deformed as among the flatheads of North America. They are of a dull, apathetic temperament, but fond of European finery.

Climate.—The climate of the Andamans and Nicobars is equatorial in its uniformity, and greatly resembles that of Tenasserim or Mergui, *see* page 382. It is not generally healthy for Europeans, but appears to improve from a hygienic point of view when the forest is cleared from any locality. The observations for temperature, &c., have been made at port Blair and Nankauri, both situated on the lee sides of the islands; possibly the western sides may be cooler during the south-west monsoon.

Port Blair and Nankauri have each a mean temperature of 80°, with but little variation during the year. March and April are the warmest months, with means of 82° and 83° respectively, and a mean daily maximum of 92° at port Blair, and 89° at Nankauri. A reading of 96° is the highest recorded at port Blair, and 99° at Nankauri; 66° and 70° the lowest temperature yet observed at those places respectively. The diurnal range of temperature is as much as 14° to 15° at port Blair in February, March, and April; it never averages more than 10° or 11° at Nankauri, and varies little there at different seasons. The mean humidity at port Blair is 83, at

Nankauri only 79 per cent., and the difference appears to hold good all the year. Over all the islands the south-west monsoon rains set in in May, and rain falls oftener in the summer monsoon in the Nicobars than it does in the Andamans. At port Blair the average annual rainfall is nearly 117 inches, upwards of 10 inches falling in each month from May to October, and 18 or 19 inches both in June and September. Not more than 5 inches fall during the whole of the first four months of the year.

At Nankauri the average annual rainfall is 110 inches, and it exceeds 10 inches in each month from May to December inclusive. Less than 12 inches fall in the whole of the first four months of the year.

MAILS and STEAM-VESSEL COMMUNICATION.—

Communication is maintained principally by the P. and O. Company and the British India Company. A weekly mail service is carried out between the United Kingdom and Colombo by the vessels of the Orient and P. and O. Companies ; and a similar service by the same companies to and from Colombo and Australia. The P. and O. Company also provide a fortnightly service between Bombay, Colombo, Madras and Calcutta ; and a similar service between Colombo, the Straits Settlements, China and Japan. The British India Company maintain a fortnightly service between the United Kingdom and Calcutta, *viâ* Colombo and Madras ; a four-weekly service between Calcutta and Mauritius, *viâ* Colombo ; and a six-weekly service from Calcutta to Australia *viâ* Singapore and Batavia, proceeding outwards westward of Australia to Adelaide, and returning through Torres Strait, calling at the principal Australian ports *en route*.

The coastal services of the British India Company are from Calcutta to Chittagong, Akyab, Rangoon, Moulmein, Tavoy and Mergui weekly, calling when inducement offers at Kyauk Pyu, Pakchan and Kopah, thence to the Straits Settlements ports, the voyage ending at Singapore. On the western shore of the bay a weekly service is maintained to and from Calcutta, calling every week if necessary at False point, Gopalpur, Bimlipatam, Vizagapatam, Cocanada, Madras, Negapatam, and Colombo ; every fortnight at Kalingapatam, Masulipatam, Pondicherri, Cuddalore, and Point de Galle ; and every month at Jafnapatam and Trincomali. After leaving Colombo the steamers on this line call at the coast ports between there and Bombay. From Bombay the British India Company run a weekly line to Karachi and the Persian gulf ports, the farthest point reached by the steamers being Basra up the Shatt

al Arab. Several other companies provide steam communication between the United Kingdom and Colombo, Madras, Calcutta and Rangoon, as well as between those ports and China and Australia.

Dock Accommodation.—Calcutta is the only port in the bay of Bengal where there are dry docks. The largest dock there is the Port Commissioner's dock at Kidderpur, its dimensions being 710 feet in length, 60 feet breadth of entrance, with $23\frac{1}{2}$ feet on the sill at high water ordinary springs. There is a slip at Rangoon that can take vessels up to 800 tons, and a gridiron at Moulmein for small vessels.

Coal can be obtained at the following ports in the bay of Bengal :—In large quantities at Colombo, Galle, Trincomali, Negapatam, Madras, Calcutta, Rangoon, and port Blair ; but at the last port only by British vessels-of-war, or those of the Indian Government. In small quantities at Cocanada and Chittagong.

A Submarine telegraph cable is laid between Madras and Penang.

BAY OF BENGAL—WINDS.*—The north-east and south-west monsoons blow over the whole of the bay of Bengal, but their strength and general direction vary in different localities. Speaking in general terms, the north-east monsoon prevails from November to March, and the south-west monsoon from May to September ; April and October are months of variable winds, and cyclones are of more frequent occurrence in October than in any other month of the year. A full account of cyclones and cyclonic storms in the bay of Bengal will be found at page 21.

In the northern part of the bay of Bengal the north-east monsoon is very light, and often a calm prevails for days together. In the middle of the bay, and southward of the mouths of the Godáviri, it blows more steadily, and is often strong south of Madras, raising a high sea, whilst up to January, stormy weather prevails off Ceylon and in the southern part of the bay. In the north-west part of the bay, the north-east monsoon has almost ceased by the end of January, but light northerly winds continue some weeks longer down the Arakan coast ; and in the middle and southern parts of the bay this monsoon lasts well into March, gradually weakening, and shifting to the eastward.

In the northern part of the bay southerly winds set in about the end of January, at first merely as afternoon sea breezes, but afterwards blowing more continuously, and gradually extending down the bay. In May, south-west winds prevail all over the bay of

Bengal, but they are still somewhat unsteady and often interrupted by calms, although these are less frequent than in March or April.

The general particulars of the mean force and direction of the winds in the bay of Bengal are as follows :—

November.—At the head of the bay the winds are generally northerly, force 2 to 4 ; to the southward, northward of lat. 8° N., they are north-easterly, force 2 to 5, being strongest off Madras, in the middle of the bay, and eastward of the Andamans. Between lat. 8° N. and 4° N. the north-east monsoon has not fairly set in, the wind being from all quarters except south, average force 2 to 3, with occasional south-west winds of force 4.

December.—The prevailing wind is north-easterly, force 3 to 4 throughout the bay ; strongest and steadiest off Madras and in the middle of the bay, but weak westward of Acheh head ; northerly at the head of the bay and off the Arakan coast.

January.—Prevailing wind north-easterly, decreasing in force to 2 to 3, northward of lat. 15° N. ; the general strength in the bay is 3 to 4, and the greatest 4 to 5 westward of Great Nicobar ; light westward of Acheh head. Westward of cape Negrais the wind is inclined to the northward, force 2 to 3 ; and westward of Kyauk Pyu it is north-westerly ; off the mouth of the Húgli, occasional south-westerly winds are felt, force 2 ; these extend on the west shore of the bay as far south as Cocanada.

February.—The prevailing wind southward of lat. 15° N. is still north-east but lighter, force 2 to 4, in the middle of the bay ; the strongest winds are eastward and south-eastward of Ceylon, force 3 to 4 ; near Acheh head the wind is light, force 2 to 3. About the Andamans the wind is northerly, force 2 to 3, inclined eastward on the west side of the islands, and westward on the east side. At the head of the bay south-west winds are nearly as prevalent as north-east. Westward of Cheduba the wind is generally northerly, force 3 ; southward of the Húgli, winds from all quarters are experienced, force 2 to 3, but south-west are more frequent than any others. In the middle and western parts of the bay, northward of lat. 15° N., the winds are north-east and south-west, force 2 to 3 ; but near the shore there are no winds between north, through west, and west-south-west. Southerly winds are felt further south than Madras.

March.—North-east winds only prevail southward of lat. 13° N., but they are generally light, force 2 to 3 ; the strongest winds are westward of Nicobars, where easterly winds have an average force 4.

In the north-west part of the bay from the mouth of the Húgli to Cocanada the wind is south-west, force 2 to 3, north-easterly winds being entirely absent in this locality. From side to side of the bay between lats. 16° N. and 13° N. the winds are variable; southerly winds, force 2 to 3, prevailing on the west side, and northerly winds, force 2, on the east side of the bay. Westward of Cheduba the winds are westerly, from north to south, force 2 to 3, those from southward of west being the stronger. Eastward of Andamans and Nicobars the winds are variable, north-westerly, force 2 to 3, being the most common.

April.—North-westward of a line from Madras to cape Negrais the wind is usually south-west; strongest in the north-west part of the bay, force 4, elsewhere in this area it has a force of 2 to 3. North-eastward of Ceylon the prevailing wind is south-easterly, force 3. In the middle of the bay westward of the Andamans, and between Ceylon and the Nicobars, the winds are variable, and from all quarters except the north-westerly, the force being 2 to 3 on the western side, and 3 to 4 on the eastern side. In the gulf of Martaban the winds are variable, force 2 to 3, but north-west winds predominate. Eastward of Andamans and Nicobars the winds are also variable, mostly from the northward, force 2 to 3; southerly winds are few, but when experienced they are the strongest.

May.—South-west wind all over the bay of Bengal, being strongest eastward of Ceylon, force 3 to 5. In the gulf of Martaban the wind is inclined to the westward. Eastward of Andamans and south-westward of Cheduba the winds are light, force 2 to 3.

June.—South-west wind all over the bay of Bengal, average force 4 to 5; strongest, force 4 to 6, westward of Ceylon, on the western shore, and in the middle, of the bay. The wind is somewhat inclined to the westward to the southward and north-eastward of Ceylon, and to the southward to the south-westward of Cheduba.

July.—The wind is south-west all over the bay, with an average force 5. It is inclined to the southward to the south-westward of Cheduba, and to the westward near the Mergui archipelago and south-eastward of Ceylon. The wind is lighter than elsewhere, off the mouth of the Húgli, south-westward of Cheduba, southward of the Nicobars, and south-eastward of Ceylon.

August.—Still strong south-west wind everywhere, except at the head of the bay, northward of lat. 19° N.; there the wind is inclined southerly between the mouth of the Húgli and False point, and

south-easterly on the eastern side of the head of the bay. The average force of the south-west wind in the bay is 5 ; it is strongest, force 6, westward of the Andamans ; and lightest, force 4 to 5, on the western side of the bay. The wind is inclined westerly south-south-east of Ceylon, and eastward of the Nicobars.

September.—The south-west wind still prevails, force 4 to 5, except on the north-east side of the head of the bay. The wind is strongest, force 6, eastward of the Nicobars, and south-east of Ceylon, in both of which localities its direction is westerly. Westward of the Andamans, the force of the south-west wind is 5 to 6 ; it is lighter, force 3 to 4, and inclined to be variable, on the western side of the bay of Bengal. Off the mouth of the Húgli, and on the eastern side of the bay as far south as cape Negrais, the winds are more southerly, force 3 to 4 on the western side, and 4 to 5 on the eastern. In the gulf of Martaban the winds are variable from the westward, force 2 to 5, but no easterly winds are experienced there.

October.—The south-west wind, average force 4, only prevails southward of the parallel of lat. 7° N., from southward of Ceylon to Acheh head. All over the rest of the bay of Bengal the winds are variable. On the eastern side of the head of the bay easterly winds prevail, force 3 ; on the western side the wind is from all quarters except south-west, the predominating direction being between north and east, force 2 to 4. South-eastward of Cocanada, easterly winds are the most frequent, force 3 to 4, with an occasional stronger southerly wind, force 5. Off Madras and eastward of Ceylon winds from all points, except northerly ones prevail, force 3 to 4 off Madras, and 2 to 3 off Ceylon. In the middle of the bay the direction is variable, but inclined to be north-easterly in the northern part, and south-westerly in the southern part, both force 2 to 3. Between Ceylon and the Nicobars, and westward of the Andamans, winds between west and south, but inclined westward in the eastern part of that area, average force 4, prevail. In Preparis channel winds are from all points except south-south-east. Eastward of Andamans and Nicobars the winds are very variable, but those from south and west are most frequent, force 2 to 4 in northern part, 3 to 5 in southern part, where the direction is steadier.

BAROMETER.*—In the bay of Bengal the movements of the barometer betokening changes of weather are comparatively small, a fall of three-tenths of an inch below the average of the time and place

* Derived from:—"Weather Charts of the bay of Bengal, &c.," published by the Meteorological Department of the Government of India.

occurring only before very disturbed weather, and it is only near the centre of violent cyclones that this amount is greatly exceeded. The barometer is generally highest during the north-east monsoon and lowest during the south-west monsoon, the annual range at the head of the bay being much greater than in the southern part. Thus at the head of the bay the mean pressure is greatest, and about 30·00 inches, from December to February; and attains its minimum, 29·60 inches, in June and July. In the middle of the bay the mean pressure is about 29·95 inches at its maximum, from December to February; and 29·75 inches at its minimum, in June and July. In the southern part of the bay, between Ceylon and Acheh head, the mean height of the barometer is about 29·90 inches during the north-east monsoon; and 29·85 inches during the south-west monsoon.

The movements of the mercury preceding bad weather being so small, it is necessary to make an allowance for the diurnal fluctuations of the barometer before attempting to predict probable changes.

These fluctuations are remarkably regular in the bay of Bengal, and are somewhat larger in the north-east than in the south-west monsoon. The maximum points occur twice daily at about 9h. 30m. a.m., and 10h. 0m. p.m.; and the minimum at 4h. 30m. p.m., and 3h. 30m. a.m. During the north-east monsoon, the average rise from the a.m. minimum to the a.m. maximum is eight-hundredths of an inch, the fall from the a.m. maximum to the p.m. minimum, nine-hundredths; the rise from the p.m. minimum to the p.m. maximum seven-hundredths of an inch; and the fall from the p.m. maximum to the a.m. minimum, six-hundredths. In the south-west monsoon the average rise from the a.m. minimum to the a.m. maximum is seven-hundredths of an inch; the fall from the a.m. maximum to the p.m. minimum is eight-hundredths; the rise from the p.m. minimum to the p.m. maximum, six-hundredths of an inch; and the fall from the p.m. maximum to the a.m. minimum, five-hundredths of an inch.

CYCLONES and CYCLONIC STORMS.†—Cyclones of hurricane force are usually generated in the bay of Bengal during the changes of the monsoons. Cyclonic storms, of less strength but generally greater area than cyclones, are most common during the south-west monsoon. These last sometimes develop hurricane force, but usually only attain the strength of a gale, with no calm centre; and are felt as partially revolving storms at the head of the bay only; their influence further southward resulting in an increase in the force of the south-west monsoon.

† Derived principally from:—The climate and weather of India, &c., by H. F. Blandford, F.R.S., &c.

Cyclones of great violence are comparatively rare in the bay of Bengal, and on the average not more than 2 occur in each year.

Cyclonic storms however sometimes succeed each other at the rate of 4 or 5 in one month. The only part of the year in which no violent storm has been recorded in the bay of Bengal is from the middle of January to the middle of March.

Indications.—The earliest indications of the approach of a cyclone in the bay of Bengal are not given by the barometer, unless in the area where the storm is in course of formation.

Before the False point cyclone of 22nd September 1885, in which the barometer fell lower than has ever been recorded at sea level in the bay of Bengal, the mercury did not begin to fall sensibly until $10\frac{1}{2}$ hours before the central calm passed over the signal station; but the weather assumed a threatening appearance 4 hours before the barometer began to fall, the wind being from north-east and blowing in fresh squalls, with an overcast sky, and heavy banks of cloud rolling up from the north-eastward. In front, usually to the north-westward, of the storm's path, the first signs of its approach are a still, oppressive, atmosphere, light variable winds from between north and east, a strong westerly current across the head of the bay, and a long south-easterly swell.

Light wisps of cirrus cloud move up from the south-west, gradually thickening to a sheet of cirro-stratus, through which the moon, when visible, may be seen surrounded by a luminous halo. A ruddy glow is observed, especially at sunrise, and a low bank of clouds on the south-eastern horizon is lighted at night by distant lightning. Water-spouts are sometimes formed in the still, vapour-charged, atmosphere before it is stirred by any indraught towards the advancing vortex.

As a rule the barometer does not begin to fall steadily until the force of the wind has increased to 6 or 8, and the centre of the storm is within a distance of 100 to 200 miles; the mercury then continues to fall slowly until the centre is 50 to 20 miles off, and when the wind has reached force 12, the fall is very rapid, and so continues until the centre has passed. The barometer rises in the rear of the storm in much the same manner that it falls in front of it, rapidly near the centre, and gradually beyond; sometimes the rise in the rear is slower than the fall in front. The weather in the front however is very different from that in the rear; in front, beyond about 200 miles from the centre, the weather is fine, often calm and sultry, and no bad weather is experienced until the centre of the cyclone is within 200 miles. In the rear the weather is squally and rainy for

400 to 500 miles from the centre, south-westerly winds prevailing to the southward, and a southerly to south-easterly gale far to the eastward of the vortex.

Tracks.—The localities in which cyclones or cyclonic storms are formed, and the paths which they pursue differ considerably, according to the time of the year. Generally, from the end of March to the middle of May, and from the middle of October to the beginning of January, storms are confined to the southern half of the bay; and from the middle of May to the middle of October to the northern half; in the last period cyclonic storms are much more frequent than cyclones. In May, the first half of June, October, and November, cyclones may occur in any part of the bay.

Of two cyclones recorded in the first week of January, both travelled westward in the southern part of the bay, one passing over Trincomali, the other over Pondicherri. One instance only has been recorded (1888), of a cyclone in January crossing India on an E.S.E. course from Baluchistan to Gopalpur, and thence across the bay to Akyab. With this exception the northern half of the bay has been free from storms from the end of the first week in December to nearly the end of April; and they are very rare in that part of the bay after the middle of November.

In March and April strong south-west winds blow at the head of the bay of Bengal, but these winds are not cyclonic at sea. No cyclones have been recorded in February in any part of the bay. Two cyclones have been recorded in March, both moving westward in the southern part of the bay, and passing over the Madras coast. In the early part of April all the cyclones observed have been in the southern part of the bay.

At the end of April and in the first half of May cyclones usually originate between the Andamans and Ceylon, and pursue a course between west and N.W. In the last half of May and in June they generally originate between the Andamans and the north-west part of the bay; their general course is north-westward, but some travel to the northward, curving eastward of north at the head of the bay; occasionally one moves in a westerly direction. One cyclone has been recorded as having passed over Madras in June.

The storms of the south-west monsoon, July to September, are principally cyclonic, and do not often develop hurricane force. They all move between west and N.N.W., and are confined to the head of the bay of Bengal northward of lat. 16° N.

In the first half of October cyclones are usually formed between

the Andamans and the north-west part of the bay, and sometimes off the Arakan coast. Like those in the last half of May their general course is north-westward, but many of them travel to the northward, and curve to the eastward of north in the northern part of the bay. Those that strike the coast near Madras in this month have usually pursued a westerly course. The course of those which originate in the last half of October, south-westward of the Andamans, is generally westward.

In November and December the majority of the cyclones originate between the Andamans and Ceylon, and move westward towards Ceylon or the Coromandel coast. In November some reach the head of the bay on a N.N.E. course; one recorded during that month in the gulf of Martaban travelled N.N.W., but usually those that form eastward of the Andamans in November pass into the bay of Bengal northward of those islands, and then curve either westward or northward and north-eastward. A violent cyclone passed over port Blair, Andaman islands, on the night of 1st November 1891; it afterwards travelled north-westward across the bay, and did much damage at the mouth of the Hügli, and on the Orissa coast.

The rate of progress of cyclones in the bay of Bengal seldom exceeds 12 miles an hour, and of those recorded the majority moved at a speed less than 8 miles an hour.

Bearing of centre.—An analysis of the cyclones that have been observed in the bay of Bengal shows that the wind blows in spirals towards the centre of the storm. The result is that in the northern part of the bay, northward of lat. 15° N., when within the influence of the storm, the bearing of its centre is about 11 points to right of the direction of the wind, and about 10 points when within 50 miles of the centre.

Southward of lat. 15° N., the bearing of the centre to the right of the direction of the wind is about $11\frac{1}{2}$ in the outer part of the storm to 10 points near the centre; and off the coast of Ceylon as much as 12 to 10 points respectively. When on the outskirts of the storm, say 500 miles from the centre, there may be an error of one to two points in the assumed direction of the centre, obtained by applying the above rule; but as the wind increases in force the rule becomes more exact, although owing to local irregularities there may be an error of one point in the assumed direction, when within 50 miles of the centre.

The following rules are of universal application in revolving storms, and should be carefully considered. A vessel is in the right hand

semi-circle if the direction of the wind shifts to the right, and in the left hand semi-circle if it shifts to the left :—

PRACTICAL RULES FOR SEAMEN IN TROPICAL CYCLONES.

When in the region, and in the season of revolving storms, be on the watch for the premonitory signs. *Constantly and carefully observe and record the barometer.*

When there are indications of a cyclone being near, heave-to, and carefully observe and record the changes of the barometer and wind, so as to find the bearing of the centre, and ascertain by the shifting of the wind in which semi-circle the vessel is situated. Much will often depend upon heaving-to in time.

When, after careful observation, there is reason to believe that the centre of a cyclone is approaching, the following rules should be followed in determining whether to remain hove-to or not, and the tack on which to remain hove-to :—

Northern hemisphere.—If in the right-hand semi-circle, heave-to on the starboard tack. If in the left-hand semi-circle, run, keeping the wind, if possible, on the starboard quarter; and when the barometer rises, if necessary to keep the ship from going too far from the proper course, heave-to on the port tack.

Southern hemisphere.—If in the right-hand semi-circle, run, keeping the wind, if possible, on the port quarter; and when the barometer rises, if necessary to keep the ship from going too far from the proper course, heave-to on the starboard tack. If in the left-hand semi-circle, heave-to on the port tack.

Both hemispheres.—When the ship lies in the direct line of advance of the storm—which position is, as previously observed, the most dangerous of all—run. And in all cases act so as to increase as soon as possible the distance from the centre; bearing in mind that the whole storm field is advancing.

Heaving-to, in both hemispheres.—If the ship be in the right-hand semicircle, heave-to on the starboard tack. In the left-hand semi-circle, heave-to on the port tack; these being the tacks on which the ship will “come up” as the wind shifts.

In receding from the centre of a cyclone, the barometer will rise, and the wind and sea subside.

It should be remarked that in some cases vessels may, if the storm be travelling slowly, sail from the dangerous semicircle across the front of the storm, and thus out of its influence. But as the rate at which the storm is travelling is quite uncertain, this is a hazardous

proceeding, and the seamen should hesitate and carefully consider all the circumstances of the case, particularly observing the rate at which the barometer is falling, before he attempts to cross.

General Remarks.—It is impossible to give exact directions, other than the above, of the course to be pursued in every case, but a few remarks of local application only may be found useful.

If a vessel is running up the bay of Bengal with a strong south-west wind, occasional squalls and rain, and a slowly falling barometer, this indicates that bad weather prevails somewhere to the northward. At any time between the beginning of June and middle of September the storm centre is probably northward of lat. 16° N., and in July or August still further northward. Under these circumstances it would seem best for a sailing vessel to steer to the eastward, so as to gain the eastern side of the storm as it moves north-westward, and take advantage of the east and south-east winds on the eastern side. But should the weather get rapidly worse, and the barometer continue to fall, it would be expedient to heave-to, and determine the vessel's position with regard to the movement of the storm before proceeding.

In May, October, or November the storm may be moving in any direction between West, North, or N.E.; and its course should be definitively ascertained before any attempt is made to round its eastern side, as if it should be travelling north-eastward such a proceeding might be attended with danger.

From June to September a vessel leaving the Húgli will be warned by easterly winds and a falling barometer, or by the Storm Signals at the telegraph stations, of the approach of a cyclone, or its existence in the northern part of the bay. In July or August the storm will probably be of moderate force, although not invariably so, but in June and September some of the most violent cyclones have visited the coasts of Bengal and Orissa. As a vessel standing to the southward would most likely run into the storm, she should not leave the river until the weather has moderated.

In May, October, or November, a squally east or north-east wind driving low long-drawn masses of cloud before it; or a strong westerly current setting across the head of the bay of Bengal; may be considered as prognostications that a cyclone is in the northern part of the bay, and a vessel should not proceed to the southward until finer weather prevails.

But in those months a cyclone may be far down the bay, and the river Húgli, or other port at the head of the bay, may have been left

with every appearance of fine weather. With these conditions, on the first indications of the coming storm, the changes of the wind and barometer should be carefully watched, and the course of the cyclone, if possible, be determined. If in the right-hand semicircle the vessel should remain hove-to on the starboard tack until the storm has passed, and if undoubtedly in the left-hand semicircle should heave-to on the port tack if the wind is eastward of North, or run to the southward, keeping the wind on the starboard quarter, when the wind is North, or westward of North.

Vessels lying in the roadsteads of the Coromandel coast on the approach of a cyclone usually try to run to the southward round the south-western quadrant, and if sailing vessels this is probably the only course open to them ; but full-powered steamers leaving while the centre is still more than 100 miles distant, and the wind between north and north-north-west, might if necessary proceed to the north-eastward, if it has been ascertained that the cyclone is not moving north-westward or northward of that.

Vessels leaving Rangoon or Moulmein and encountering strong north-east winds, with a falling barometer, indicating the existence of a cyclone eastward of the Andamans, should delay their departure until the storm has passed, which will be indicated by a rising barometer, and the wind changing to east or southward of east.

STORM SIGNALS are shown at the following ports on the shores of the bay of Bengal :—

Tuticorin.	Bimlipatam.	Húgli river.
Negapatam.	Gopalpur.	Chittagong.
Madras.	Puri.	Akyab.
Masulipatam.	False point.	Bassein.
Cocanada.	Chandbali.	Rangoon.
Vizagapatam.	Balasor.	Moulmein.

The general signals shown are as follows, but additional signals, having special local significance, are shown at the signal stations of the Húgli river, and elsewhere, these last will be found in the text under the descriptions of the various ports.

Day Signals.—A *ball* indicates the probable approach of dangerous weather.

A *drum* indicates that a cyclone is likely to approach the port.

Night Signals.—*Three lights*, placed *vertically*, one above the other, indicate the probable approach of dangerous weather.

Two lights, placed *vertically*, one above the other, indicate that a cyclone is likely to approach the port.

INSHORE CURRENTS.*—The inshore currents here given are those that usually run within 50 miles of the coast, but outside the influence of tidal streams.

December to February.—On the eastern and south-eastern coasts of Ceylon the current runs to the southward, generally parallel to the shore. North-eastward of Palk strait up to lat. 12° N. the set is south-westerly. From off Pondicherri to False point, the general direction is northward, parallel to the shore, but the current sets towards the coast westward of False Divi point. In December the south-west set is found considerably southward of False point; whereas in February the northerly current prevails all along the west shore of the bay of Bengal. From False point to the head of the bay, in long. 90° E., the current runs south-west; off Akyab the direction is north-west, inclining to the northward in the north-east part of the head of the bay. Off Cheduba island the set is south-easterly, and between that island and cape Negrais it is to the southward. In the gulf of Martaban the current runs to the westward; it also runs westward through the passages between the Andaman islands, and slightly northward of West through the Nicobars. Westward of Acheh head its direction is northward.

March to May.—On the south coast of Ceylon the current runs to the south and west, but alters its direction to the eastward in May; off the east coast, in the parallel of the Basses, it sets westward, but generally southward along the east coast; and off the N.E. coast of Ceylon north-westerly. Along the Coromandel coast, to the latitude of False point, the direction is northward and north-easterly, parallel to the shore. Off Sacramento shoal and Godavari point this current sometimes runs at the rate of 4 knots an hour in March and April, its direction being inclined towards the shore northward of Coringa bay. On the western side of the head of the bay the set is easterly; and south-easterly off the mouth of the Hugli. Between 90° E. and Akyab the current runs north-north-east; in the same direction off Cheduba; and north-easterly between there and cape Negrais. In the gulf of Martaban the set is south-easterly off the Irrawaddy mouths, and easterly southward of the mouth of the Moulmein river. The current runs north-north-west eastward of the north end of Great Andaman;

* From "Charts of the bay of Bengal, &c., shewing the Currents of the Sea Surface, &c.," published by the Meteorological Department of the Government of India.

south-westerly, eastward of Little Andaman ; west-north-west, past Kar Nicobar ; and northerly past Great Nicobar. Westward of Acheh head its direction is north-easterly.

June to August.—The general set of the currents on the south and south-east coast of Ceylon is between south-east and north-east, but they are very capricious, and frequently run in other directions. There is usually a south-easterly set along the east coast.* From the north end of Ceylon up to Vizagapatam, it runs northerly and north-easterly parallel to the shore ; and between the mouth of the Húgli and Kalingapatam the direction is south-westerly, flowing rather onshore northward of False point. Northward of Akyab the current runs to the northward, somewhat towards the shore ; and between there and cape Negrais its direction is north-easterly, right onshore. In the gulf of Martaban the set is north-easterly off the Irrawaddy mouths ; and easterly, southward of Moulmein ; northerly between there and the Mergui archipelago ; and easterly, westward of those islands. The current runs to the northward past the Great Andaman, easterly past Kar Nicobar, and south-easterly past Great Nicobar. Westward of Acheh head its direction is eastward.†

September to November.—Off the south-east coast of Ceylon the current sets south-south-east offshore, and south-easterly along-shore off the N.E. coast of the island. Between the north end of Ceylon and lat. 13° N. its direction is southerly, parallel to the shore. In October and November the southerly current is very strong off Madras, sometimes attaining a rate of 4 knots an hour. It sets easterly, southward of False Divi point ; south-westerly off Cocanada ; easterly off Gopalpur ; west-south-west at Palmyras shoal ; and westerly, southward of the Húgli mouth. Northward of Cheduba island it runs north-westerly, and east-south-easterly between there and cape Negrais. In the gulf of Martaban the set is west-north-west off the Irrawaddy mouths ; and southerly from

* A remarkable circumstance occurs with regard to the current during the south-west monsoon, in the vicinity of the Basses. After running 3 knots to the north-east for ten days, suddenly it slackens, and runs from 2 to 3½ knots south-west, or from the bay of Bengal, lasting sometimes one day, at other times for a week ; these changes happen at all times of the moon, and appear to obey no recognised law. (From Report of Mr. Buchanan, master of the former Little Basses light vessel, April 1869.)

† In July and August a south-west current running in the teeth of the monsoon, at the rate of 20 to 35 miles per day, has been reported by several vessels between Acheh head and Great Nicobar. H.M.S. *Rifleman*, in August 1878, experienced a south-west set of 2 knots an hour, the wind at the time being south-east, force 2 to 3.

Moulmein past the Mergui archipelago. The current runs south-westerly on the east side of Great Andaman ; southerly, eastward of Little Andaman ; south-easterly past the northern islands of the Nicobar group ; and northerly, westward of Great Nicobar. Westward of Acheh head its direction is north-north-east.

OFFSHORE CURRENTS.†—The offshore currents here given are those in the bay of Bengal at a greater distance than 50 miles from the shore.

December to February.—The general circulation of the water in these months is from east to west. From the north end of Sumatra and the Nicobars the current runs almost due west towards Ceylon, turning south-westerly when within 100 miles of the west coast of that island. At about 200 miles from the northern end of Ceylon, a portion of the westerly current trends north-westerly.

Between the Andamans and the western shore of the bay in the same latitudes, the general set is due west. About 100 miles westward of Little Andaman the current runs south-westerly ; and 150 miles off Madras it sets north-westerly. Midway between Little Andaman and the north end of Ceylon the current is somewhat irregular and occasionally sets to the eastward.

In the sea eastward of the Andamans and Nicobars ; in the latitude of Great Nicobar the current is westerly ; in that of the north end of the Nicobars and Little Andaman it is southward and south-easterly, and eastward of Great Andaman it sets north-westerly and westerly.

Towards the head of the bay, the current sets southward and south-south-west for 250 miles N.W. of the north end of Great Andaman, and then (southward of the 18th parallel) west-south-west and west, turning north-west when 100 miles from the western shore of the bay. On the parallel of Cheduba island the set is slightly southward of west 150 miles from the island, eastward of south 250 miles from it, and south-west when within 100 miles of the western shore of the bay.

March to May.—The general circulation of the water in these months is north-westerly in the southern half of the bay and north-easterly in the northern half.

† From "Charts of the bay of Bengal, &c., shewing the currents of the sea surface, &c.," published by the Meteorological Department of the Government of India.

Between the Nicobars and Ceylon the current sets north-westerly, turning westward 200 miles from the Basses; and north-easterly about 250 miles eastward of Trincomali, but midway between that position and Trincomali it runs again to the north-westward. Westward of South Andaman the direction is northerly at 100 miles off, turning north-west in the middle of the bay, and westward in long. 85° E., but altering its course again to the north-westward between there and the western shore of the bay. On the parallel of North Andaman the currents run westerly on the eastern side, south-westerly in long. 89° W., and turn westerly and northerly on the western side of the bay. Eastward of the Andamans and Nicobars, the current pursues a northerly course; but in the middle of the entrance to the strait of Malacca its direction is southerly. Northward of lat. 14° N., the general direction of the current is east-north-east, turning slightly southward of east, 100 to 400 miles westward of Preparis island, and more northerly near the Arakan coast.

June to August.—In these months the general direction of the current is easterly.

Eastward of Ceylon, the set is easterly, inclining north-east in the middle of the bay, and towards Sumatra and the Nicobars. Off the north-east coast of Ceylon, in long. 82° E., the current runs north-westerly. Westward of the Andamans, the direction is usually north-easterly, but south-easterly in long. 85° E., in latitude of middle of Great Andaman, and north-north-west in the same latitude in long. 87° E. Eastward of the Andamans and Nicobars the current runs easterly as a rule, but it is inclined northerly westward of Tavoy river; south-easterly in long. 95° E., on parallel of Kar Nicobar; and north-north-east northward of Acheh head.

Northward of lat. 15° N., the general set is north-easterly. The current runs northerly on the western side of the bay in lat. 15° N.; about east-north-east on the parallel of 17° N.; northerly at 100 miles south-eastward of False point; easterly in the middle of the bay in lat. 20° N.; and north-easterly on the eastern side in that parallel.

September to November.—The general direction of the current is north-east.

Eastward of Ceylon the current runs Easterly, inclining to the northward towards Sumatra and the Nicobars.

On parallels of the Andamans, and westward of those islands, the usual set is Easterly. But the current sometimes runs west-

south-west in long. 85° E.; east-south-east in long. 83° E.; and north-north-west at 100 miles westward of Great Andaman.

Eastward of the Andamans and Nicobars the general direction is north-west; but south-easterly westward of and within 100 miles of Mergui archipelago.

Northward of lat. 15° N. the currents are very irregular; but they run usually southward of west in the north-west part of the bay; and northward of East in the north-east part.

Note.—Further details of currents, especially in the vicinity of the Basses rocks, and approaching Trincomali will be found in the text. *See* also Monthly statement of currents and winds on the coast of Ceylon, by Mr. Thomas Robson, pages

Strength of Currents.—On the coast of Ceylon the rate of the current is 18 to 60 miles per day, but in the north-east monsoon a speed of nearly 100 miles a day has been observed on the east and south-east coasts of the island.

Along the western shore of the bay of Bengal the rate is usually 12 to 40 miles a day, being strongest near False Divi point and off Coringa bay and Madras at certain times. On the eastern side of the bay the general speed is 12 to 30 miles per day; and between Acheh head and the Nicobars from 20 to 50 miles per day.

Between Ceylon and Sumatra the current runs 24 to 78 miles a day in the south-west monsoon, and 12 to 60 miles a day in the north-east monsoon. In the middle of the bay the speed is about 24 miles a day.

TIDES.—The tidal undulation in the bay of Bengal appears to travel from south-west to north-east, with a regularity which may be fairly traced. At Colombo four high and low waters have been observed in the course of 25 hours, the difference of high and low water being only 6 inches.

It is noticeable that the time of high water at Trincomali on the east coast of Ceylon is six hours behind that at Point de Galle on the south-west coast of that island, the latter again occurring one hour after high water at Colombo on the west coast with the same rise in each case, of two feet at springs. When it is high water at Trincomali it is low water at Galle, and *vice versa*; whereas simultaneously at Kirindi and Batticaloa, situated intermediately between the two places, it is respectively, quarter and half tide, denoting affinity in the progress of the tidal wave in this vicinity. At Pambam (Paumben), on the north side of Ceylon, the time of high water is akin to that

of Galle and Colombo, whereas Nagar and Madras on the Coromandel coast have nearly the same time of high water at springs as Trincomali, differing about six hours with Pámbam, although the rise at springs of 3 feet is about the same.

On both sides of the bay the progress of the tidal undulation is distinct, both in time of arrival and increase of volume.* After passing Madras, the tidal wave continues along the west shore of the bay of Bengal and arrives later and has a greater rise as the head of the bay is approached. Thus at Cocanada the time of high water is forty minutes later than Madras and the spring rise has increased from $3\frac{1}{2}$ feet to 5 feet, at False point the rise increases to 7 feet, at the mouth of the Dhamra river to 10 feet, and in Balasor roads and at Saugor island at the mouth of the Húgli river to 12 and 15 feet. At the light-vessel off the entrance to the Mutlah river, farther south or seaward than Saugor island and Balasor roads, and almost in the same latitude as the Dhamra river entrance and Pilots ridge, the time of high water is about the same, and the rise at springs equal, or from 9 to 10 feet.

At the mouth of the Karnafuli or Chittagong river, in the north-east part of the bay of Bengal, which the tidal wave reaches late, and where the volume is swollen by the waters of the Meghna river, the rise is about 15 feet, and time of high water, full and change, is 0h. 45m.

On the east coast of the bay at positions near the sea coast not complicated by river discharge, the time of high water on the day of full and change will be found almost simultaneous, and the spring rise equal; for at Akyab, Kyauk Pyu, and Bassein river entrance, the time of high water is between 9h. 45m. and 10h.; and the spring rise 8 to 9 feet. As we follow the tidal wave up the gulf of Martaban however, the discharge from the Irrawaddy mouths, the Sittang, and the Salween rivers is met with, the time of high water becomes later, and the rise increases.

Throughout the Andaman and Nicobar islands the time of high water appears to vary from 9h. 15m. to 10h., and the rise at springs to fluctuate between $7\frac{1}{2}$ and $9\frac{1}{4}$ feet.

Along the Tenasserim coast, at the entrance of the Tavoy river, and in Mergui harbour, the time of high water is about the same, viz., 10h. 30m., and the spring rise about 18 feet; but at Junkseylon island, situated some four degrees of latitude further to the south

* See Admiralty Tide Tables, published annually, giving times and heights of high water at full and change for the principal places of the globe.

on the same line of coast, the time of high water is twenty minutes earlier, and the spring rise of 9 feet, similar to that of the north part of Sumatra, the Andaman, and Nicobar islands.

The set of the tidal streams on the various coasts, with further information, will be found included with the more detailed descriptions of those coasts, hereafter given.

Diurnal inequality.—The tides in the bay of Bengal are largely affected by diurnal inequality, both of time and height. For the principal ports, the tidal data, as calculated by harmonic analysis, are published annually by the Indian Government.

The only general rule that can be given with regard to the principal inequalities of height, is, that the day tides are highest when the sun has north declination, and the night tides when the sun has south declination; this is more decidedly apparent at springs, but is not invariably the case at neap tides.

In the northern parts of the bay of Bengal, as well as on the Martaban and Tenasserim coasts, the diurnal inequality may either accelerate or retard the times of high and low water to the amount of nearly an hour, and increase or diminish the rise by upwards of a foot.

The Bore.—No accurate observations have been made on any of the bores which are met with in the river mouths on the northern and eastern shores of the bay of Bengal. These bores only occur at springs or other unusually high tides, and generally speaking the height of the wave in the navigable channels is not such as to affect a ship, though small craft keep out of its way, or move off the shallows into the deeper water.

The localities where bores are best known are in the Húgli and the Meghna of Bengal, and the Pegu, and especially the Sittang river of Burma. They mainly occur during the south-west monsoon season; but should the moon be in perigee, at full or change, at other seasons, a bore may then be formed.

THE SURFACE TEMPERATURE of the sea in the Bay of Bengal is warmest in May and coldest in February, the annual variation being about 6° in the southern part of the bay, and 9° in the northern part.

In February the average temperature is 81° to 82°, between Ceylon and the Nicobars, gradually decreasing towards the head of the bay to 76° and 77°. In the sea eastward of the Andamans the temperature in this month is 79° to 80°.

In May the average temperature of the water surface all over the bay of Bengal is 84° to 86° . A temperature of 87° is attained between Ceylon and the Nicobars; and 82° is recorded between the north end of Ceylon and Madras.

In August the average mean temperature of the surface water of the bay is 82° to 83° ; and it is the same in November.

SOUNDINGS.—On the south coast of Ceylon the 100 fathom line is about 10 miles off shore, the descent from 40 to upwards of 100 fathoms being very steep. The edge of the bank has been exactly defined between the Great Basses and Trincomalí, and is at an average distance of 10 miles from the shore; but in several places deep narrow guts approach much nearer the coast, notably at about 3 miles northward of Batticoloa roads, and into Trincomalí Great bay.

At the first of these positions there is a depth of 191 fathoms $2\frac{1}{2}$ miles from the coast; and 506 fathoms 2 miles further out, with soundings of less than 40 fathoms one mile north, and the same distance south of it. In Trincomalí Great bay soundings of more than 400 fathoms are found well into the bay, to a distance of about one mile from Round island. Northward of Trincomalí the 100 fathom line gradually extends farther from the coast, until N.E. of the northern end of the island it is about 30 miles off.* The 100 fathom line has not been defined along the whole extent of the west side of the bay of Bengal. Off Calimere point the bank extends about 30 miles from the coast, 25 miles off abreast Negapatam, 10 to 12 miles off near Porto Novo and Cuddalore, and 10 miles off southward of Nellore. Between False Divi and Divi points it is 10 to 15 miles from the coast, and about the same distance up to Cocanada. Northward of that the edge of the bank is farther seaward, being 20 to 25 miles from the coast up to about lat. 20° N.

The water shoals around the low sandy entrance to the Dhamra river and Palmyras point, into Balasor road, in which the depths are from 5 to 15 fathoms, and the decrease gradual as the shore is approached.

The Pilots ridge, is an extension of the Palmyras shoals from which it is distant 20 to 25 miles, and has depths of 17 to 20 fathoms at low water. The soundings seaward or eastward of the Pilots ridge deepen from 23 to 30 fathoms, and the bottom is an olive green

* An extensive bank, lying about 50 miles off shore, N.N.E. to East of Muletiyu, with a least depth of 25 fathoms on it, which was reported by H.M.S. *Scout* in January 1863, was searched for by H.I.M.S. *Investigator*, Commander Carpenter, in 1890, when soundings upwards of 1,990 fathoms were obtained in the locality.

mud, whereas on the ridge, inside the 20 fathom line, the bottom consists of sand, broken speckled shells, and small pebbles of a rusty red colour.

The northern part of the bay has a complicated variety of finger shaped banks, the under-water extension of the numerous low alluvial islands forming the delta of those vast rivers and their effluents, the Ganges and the Brahmaputra. Here too occurs the "Swatch of No Ground," a depression situated about midway between the Balasor and Chittagong sides of the bay. This submarine ravine is upwards of 100 fathoms deep at 20 miles from the flat mangrove islands of the delta, with depths upwards of 400 fathoms 20 miles farther south-westward. The Swatch is generally about 10 miles in width, and has depths considerably below 100 fathoms on either side of it. The bottom, in the Swatch, consists of very soft mud.

On the Burma coast, between Akyab and cape Negrais, the soundings are more broken in character, detached islets and rocky banks abounding. Here, too, the 100 fathom line has not been defined, but would seem to extend, with a general north and south trend, about 35 miles off shore. Abreast the south-west side of Cheduba island however the 100 fathom line is less than 10 miles from the island.

The Andaman and Nicobar islands are the elevated portions of a submarine ridge which extends from the range of mountains terminating in cape Negrais to the north coast of Sumatra. Deep breaks in the Ten Degrees channel, and opening between the Great Nicobar island and the islands off the north-west point of Sumatra, occur in this submarine ridge, but on the whole it is of continuous character.

In the gulf of Martaban, where the silt brought down by the Irrawaddy, the Sittang, and the Salween rivers, succeeds in driving even the fifty fathom line to a distance of 80 miles off shore, the soundings are better defined.* Off the Tenasserim coast and Mergui archipelago, the soundings vary from 100 fathoms at 100 miles off shore, abreast or westward of the Tavoy river, to the same depth at a distance of 30 miles westward of Junkseylon island. Eastward or inshore of this, the depths are as varied as might be expected in the

* In the area comprised (approximately) between lats. 15° and 15° 30' N., longs. 96° and 97° E., the soundings are reported to be considerably less than heretofore shown on the Admiralty charts. Depths there cannot, therefore, be taken as a guide to position.

approach to such a labyrinth of islands and rocks, though apparently seldom more than 50 fathoms.

Deep Soundings.—The 1,000 fathom line follows the contour of the bay of Bengal, running apparently at an average distance of about 50 miles from the western shore, crossing the bay in about lat. 19° N., turning to the southward about 40 miles south-west of Cheduba island, and passing about 50 miles westward of the Andaman and Nicobar islands. The depths in the middle of the bay, between the Andamans and Madras, are between 1,600 and 1,700 fathoms. The 2,000 fathom line runs parallel to the east coast of Ceylon, and at a distance of about 30 miles from it, to about lat. $9^{\circ} 30'$ N. It then trends across the entrance of the bay towards the north end of Sumatra. About 300 miles westward of Acheh head a depth of 1,380 fathoms, globigerina ooze, has been obtained.

A basin of deep water, having over 1,000 fathoms, appears to extend from near Acheh head, Sumatra island, towards the gulf of Martaban, about 500 miles in length by 100 to 150 miles in breadth, the bottom consisting of mud.

UNIFORM SYSTEM OF BUOYAGE.—The following system of buoyage has been adopted in Indian waters, but of the ports described in this work, it does not apply to the buoyage of the Húgli or Rangoon rivers :—

The side of the channel is to be considered starboard or port, with reference to the entrance to any port from seaward.

The entrances of channels or turning points are marked by conical buoys, with staff carrying globe, or triangle, or basket—black buoys on starboard side of the channel, red buoys on port side.

The sides of channels are marked as follows :—

Conical buoys, painted black, mark the starboard side ; can buoys, painted, red mark the port side.

Where a middle ground exists in a channel, each end of it is marked by a conical buoy, coloured red on one side, black on the other, with a double beacon, either of basket and globe, or basket and triangle, as may be desirable. In case of this middle ground being of such extent as to require intermediate buoys, they are of shapes and colours as on the sides of a channel.

Wrecks are marked by nun buoys coloured green.

Fairway buoys are conical, and chequered black and white.

Where channels are named in large rivers, such as the Húgli, the initial letter of the channel's name, preceded by the letter L. for

Lower, C. for Central, or U. for Upper, may be painted on the buoys—thus, L.E. for Lower Eden; C.E. for Central Eden, &c.

Isolated sunken rocks are marked by conical buoys coloured red.

PASSAGES.—FULL-POWERED STEAM VESSELS.*—

These passages are always as direct as circumstances will permit.

Gulf of Aden to Bay of Bengal.—The route is northward of Sokotra, southward of Minikoi, and direct to port after rounding Ceylon.

Cape of Good Hope to Bay of Bengal.—The course is southward of Madagascar, and westward of Réunion and Mauritius; thence westward of Cargados Carajos and the Chagos archipelago to ports on the western shore of the bay of Bengal, and Calcutta, Chittagong and Akyab; and eastward of Cargados Carrajos and the Chagos archipelago if bound to Bassein, Rangoon, and ports to the southward of them.

Bay of Bengal to South Coast of Australia.—From Calcutta, and ports to the eastward of it, the route is westward of Acheh head, and eastward of the Keeling islands.

From Madras the great circle to cape Leeuwin passes close to the Keeling islands. From Colombo, the course is westward of the Keeling islands.

AUXILIARY STEAM VESSELS AND SAILING VESSELS.—First and Second Outer Passages.—The First Outer passage from the Cape of Good Hope to the bay of Bengal is taken by vessels if they expect to pass the equator from May to September, with a certainty of gaining their port before the end of the south-west monsoon. On leaving the Cape of Good Hope, steer to the southward and run down the easting on the parallel of 38° or 39° S., as far as the meridian of 62° E. From thence steer to the north-eastward, so as to enter the southern limit of the south-east trade between lats. 26° to 28° S., and longs. 80° to 82° E. In proceeding to the northward care should be taken to gain easting to counteract the effects of the westerly currents, and to be prepared for the wind shifting to the northward; for in standing across this trade it often happens, particularly in March, April, and May, that the wind is more from east and east-north-east than from south-east. At this period of the year the south-east trade blows as far as the equator, and a vessel, having arrived in lat. 1° or 2° N., may be almost

*See Admiralty chart of the world, showing tracks followed by full-powered steam-vessels, No. 1077.

certain between May and September of the south-west monsoon carrying her to Calcutta, or any part of the bay of Bengal. If bound to Ceylon stand to the northward across the south-east trade, and keep a little to the westward of Galle, if bound there.

The Second Outer Passage is taken by vessels when it is likely the bay of Bengal will not be reached before the south-west monsoon is over, or when expecting to pass the equator between October and April, and not to arrive in the bay until the north-east monsoon has set in. From the cape of Good Hope run to the eastward, as before, between the parallels of 38° and 39° S., and gain sufficient easting to cross the southern limit of the south-east trade, (lat. 26° to 28° S.), on the meridian of long. 85° to 88° E. From thence steer to the northward through the trade, and gradually gain sufficient easting to counteract the effects of the current, and to lie up for Acheh head, the northern point of Sumatra. A reasonable distance however should be kept from Hog island, and the north-west coast of Sumatra, for here a vessel may be subject to delay by baffling winds and hard squalls from north-west, with a current setting into the strait of Malacca, particularly in October and November, when north-west and west winds sometimes prevail there.

After passing about 100 or 150 miles westward of the north-west coast of Sumatra, the west side of the Nicobar islands may be approached. If the wind is inclined to keep to the westward, give the islands a good berth, but if the wind is from the north-eastward steer up the bay close-hauled, passing westward of the Nicobars and Andamans unless bound to ports eastward of them. On the parallels of 16° or 17° N. the wind often shifts to the northward, and favourable tacks may then be made to the eastward at times. Vessels bound to the Húgli should not then approach either shore, but work to windward in the middle of the bay, where smooth water and moderate winds will be found. Vessels passing close westward of the Nicobars have often reached the entrance of the Húgli without making a tack. If the equator is crossed late in February or in March keep well to the westward in standing up the bay.*

There is no difficulty in proceeding from southern to northern ports in the bay of Bengal during the south-west monsoon, nor from northern to southern ports during the north-east monsoon. Vessels bound from a port on the east side to a port on the west, may easily make the passage during the north-east monsoon ;

* See Admiralty chart of the world, showing tracks followed by vessels with sail and auxiliary steam power, No. 1078.

so also may vessels from a western to an eastern port during the south-west monsoon. When the monsoon is contrary, it results that a sailing vessel must work up or down as the case may be ; or after standing some distance across the bay then shape course for her destination. At the change of the monsoon, the voyage may be tedious, for the light and variable winds of this period are as often adverse as favourable ; every slant should then be taken advantage of, and the north-east coast of the bay avoided as much as possible, unless bound to or from one of the ports on that side of the bay.

If working down the bay of Bengal in the south-west monsoon, every endeavour should be made to keep well to the west of the Andaman islands so as not to make them a lee shore, in case a strong westerly gale sets in. At this season, it will be found advantageous to pass north of the Andaman islands, through the Preparis north or south channel, and then work to the southward in the comparatively smooth water found eastward (or to leeward) of those islands and the Nicobars.*

General Sailing Routes and Passages for the Bay of Bengal.—In any of these routes which lead a vessel across the south-east Trade wind, there will be a tendency for such vessel to be set to the westward with the surface drift, for which due allowance must be made.

Further information will be found in the body of this work, under the heading of “directions” for making the more important ports.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
1. ROUND CAPE OF GOOD HOPE TO BAY OF BEN- GAL.	Having rounded cape of Good Hope and run down easting, steer to cross lat. 2° S. in long. 80° to 82° E. then proceed to northward tending to eastward in S.E. trade. Cross equator in long. 82° E. thence to port in Bengal. For east coast Ceylon or Coromandel coast, cross equator in long. 82° E. and make the land to southward of the port. For Galle cross equator in 79° E.	After rounding cape of Good Hope and run down easting, cross lat. 28° S. in long. 85° to 88° E. thence to northward passing 120 miles westward of north point of Sumatra. Thence to westward of Nicobar islands. From this position vessels often make north part of the bay of Bengal without tacking. If bound to Madras or east coast of Ceylon, a direct course can be shaped from position off the Nicobar islands.

* Fast sailing vessels from Calcutta, in the south-west monsoon, often beat down the bay of Bengal, reaching about 100 miles west of the Andaman islands ; but the wear and tear will be found great, and the saving in time but slight.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
2. BAY OF BENGAL TO ROUND THE CAPE OF GOOD HOPE.	Work down the bay; or pass through Preparis south channel or Coco channel, then working to southward east of Andaman and Nicobar islands, and out west through Bengal passage. Cross the equator in 89° E. keeping on tack which makes most southing. After reaching S.E. Trade winds steer for Rodriguez; thence 90 miles south of Madagascar, then as requisite round cape of Good Hope. From Madras or Coromandel coast work down the west shore of the bay to Pondicherri, then stand off into bay close hauled. In offing keep on tack on which most southing can be made, to equator, then proceed as above.	Round coast of Ceylon, and cross equator in 83° E. long., then for 300 miles south-eastward of Rodriguez, and thence to pass 90 miles south of Madagascar. From there steer W.S.W. so as to make the Natal coast, then round cape of Good Hope as convenient.
3. GULF OF ADEN TO BAY OF BENGAL.	Steer northward of Sokotra and southward of Minikoi, round Ceylon, and direct to port.	Along the south coast of Arabia to about long. 52° E., then steer to round Ceylon, and having passed that island, make sufficient easting on parallel of 5° N. before standing for port.
4. BAY OF BENGAL TO GULF OF ADEN.	Same as No. 11 to near Chagos archipelago; then steer to the westward to pass northward of the Seychelles, cross the equator in long. 55° E., and thence to pass between Ras Hafun and Sokotra.	Round Ceylon, then southward of Minikoi, and northward of Sokotra.
5. S.W. AUSTRALIA TO BENGAL.	Steer to the north-west for the S.E. coast of Ceylon, and proceed up the western side of the bay of Bengal to destination.	Steer to the north-west through the S.E. Trade wind so as to enter the N.W. monsoon in 85° E. long.; then shape course toward North point of Sumatra, and proceed westward of Nicobar and Andaman islands up the bay to destination.
6. BENGAL TO S.W. AUSTRALIA.	As in No. 2 until south of Nicobar islands; then lay out of the bay on starboard tack, cross S.E. monsoon and Trade wind, and entering the westerly winds proceed as requisite.	Steer to pass 90 miles west of Andaman and Nicobar islands, having entered N.W. monsoon proceed along S.W. coasts of Sumatra and Java, giving the islands a good berth in case wind veers to S.W. Having reached long. 110° E., stand across the S.E. Trade wind into the westerly winds, and then to the eastward as requisite.
7. MALACCA STRAIT BENGAL.	Pass westward of the Nicobar and Andaman islands.	East or west of Nicobars as wind permits. If east, enter the bay by the Ten Degrees channel or between Little Andaman and Kar Nicobar islands.
8. BENGAL TO MA- LACCA STRAIT.	Through Preparis south channel, thence for Barren island and the Sayer islands, avoiding the Andaman islands and Tenasserim coast alike.	Through either Preparis north or south channel, then shape course to the southward.
9. RANGOON OR MOULMEIN TO BENGAL.	Pass through Preparis north or south channel, thence for destination.	Pass outside shoals on coast of Pegu and south of Alguada reef, thence along coast of Burma about 30 miles distant, before stretching across to destination.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
10. BENGAL TO MOULMEIN OR RANGOON.	Sight Great Coco and Table islands, pass through Preparis south channel, then steer to make China Bakir lighthouse, allowing for tidal set.	Sight cape Negrais passing south side of Alguada reef before making easting. Avoid the Baragua flats. If at night endeavour to sight the Krishna light. Make the China Bakir lighthouse.
11. BENGAL TO PORTS ON WEST COAST OF INDIA.	Cross equator, enter S.E. Trade wind, steer west between lat. 4° and 5° S., well north of Speaker bank of Chagos group; then recross equator in 62° or 63° E.* Run down the westing between lat. 8° and 9° S., passing south of Chagos islands. From long. 70° E. bear away to cross the equator in 62° or 63° E and for destination.	Down the west side of the bay and at convenient distance from coast of Ceylon. After passing cape Comorin keep in sight of the west coast of India, so as to profit by the sea breezes.
12. COROMANDEL COAST TO RAN- GOON OR MOUL- MEIN.	Sight Landfall island of Andaman islands if wind hang southerly, or Great Coco island if wind draws westerly. Pass through Coco channel, thence eastward, sighting Narkondam island, and then to make China Bakir light-house.	Make to the northward, taking either Preparis north, or south channel, then as requisite for sighting China Bakir lighthouse.
13. RANGOON OR MOULMEIN TO COROMANDEL COAST.	Keep well out to sea if the wind becomes westerly, and endeavour to sight Narkondam island. In working south, keep west of, and a moderate distance from the Mergui archipeligo. Pass through the Bengal passage, thence making the most of every change of wind, work westward towards destination.	Pass through Preparis north channel and thence direct to destination.
14. COROMANDEL COAST OR CEY- LON TO MA- LACCA STRAIT.	Steer to pass between Sumatra and Great Nicobar island, guarding against southerly set, thence through Bengal passage, sighting Pulo Buton, and keeping Malay side of strait.	If from Ceylon pass close to south end of Great Nicobar island, and endeavour to close the Malay coast. If from Madras pass through Sombrero channel of the Nicobar islands.
15. MALACCA STRAIT TO CEY- LON OR TO THE COROMAN- DEL COAST.	From Diamond point to Acheh head, keep near north coast of Sumatra, then through Bengal passage, keeping close to N.E. side of Pulo Brasse. From a good berth off Acheh head cross the equator into S.E. Trade wind, then a westerly course to same longitude as port, then north, falling in with the land on west side of Point de Galle, where west wind and east current prevail at this season.	Pass either side of the Pulo Pera. borrow towards Pulo Ronda, or or south end of Great Nicobar island. If bound to Galle make land to northward of Little Basses. If to Coromandel coast, keep on the Malay coast until Junkseylon is reached, thence through either Ten Degree or Sombrero channel (Nicobars). In December and January take care to make the land to northward of intended port on account of southerly set on Coromandel and Ceylon coasts.
16. COROMANDEL COAST. OR CEYLON TO BENGAL.†	Direct. Keep a moderate distance from the land, not closing it until north of Vizagapatam.	Make easting across the bay, and nothing on the east side or in the middle.

* This is the northern route, and can only be followed in June, July, and August, or when the south-west monsoon is at its height.

† In February and March, possibly steer direct, or stand to eastward. In September and October, stretch over to North Andaman island or cape Negrais, when 100 miles westward of either, tack to north-west.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
17. BENGAL TO COROMANDEL COAST OR CEY- LON.	Make southing without closing the east side of the bay. Steer for your port when 60 miles to southward of it.	Steer direct, but not too near west coast. In September, with light south winds, work to south-west keeping in soundings, or stand out to sea, making use of every avail- able slant of wind.
18. STRAIT OF MALACCA TO RANGOON OR MOULMEIN.	Sight Narkondam island, thence steer to sight China Bakir light- house.	Sight West Torres island (western of the Mergui archipelago), thence steer to sight China Bakir light- house.
19. RANGOON OR MOULMEIN TO STRAIT OF MA- LACCA.	Act as in No. 13, passing south point of Junkseyon, and thence steer as requisite for Penang island.	Keep outside the Mergui archipelago, then sight the south point of Junk- seyon.
20. RANGOON OR MOULMEIN TO ACHEH.	Act as in No. 13, but get to west- ward towards Nicobar islands, or make for the north coast of Sumatra, where the west cur- rent will be favourable for Acheh.	Steer direct.

For directions to or from Tavoy and Megui, *see* footnotes, pages

To the foregoing summary may be added the following general rules for sailing vessels navigating the bay of Bengal.*

Time of the Year.	Bound North or up the Bay.	Bound South or down the Bay.
From 15th January to 31st May.	Take the west side - - -	Take the east side.
In June, July, August -	Keep in the middle of the bay -	In the middle of the bay, or take the east side, pass east of the Andaman islands, and round Acheh head.
In September, October, and November.	Take the east side - - -	Take the west side.
In December and to the 15th January.	Keep the middle of the bay, and make short tacks.	Keep the middle of the bay.

* Captain J. H. Miller, in the Nautical Magazine for 1843.

CHAPTER II.

SOUTH-WEST, SOUTH AND EAST COASTS OF CEYLON.
COLOMBO TO POINT DE GALLE, THENCE TO POINT
PEDRO.*

VARIATION, 1° E. IN 1892.

THE WEST COAST OF CEYLON† is low near the sea, and much planted with cocoa-nut and other trees. Inland the mountains attain a great elevation; Adam's peak, the highest land visible from off the west coast, rises to a height of 7,353 feet, and is 35 miles from the sea; it is veiled in haze during the south-west monsoon, though an excellent landmark for two-thirds of the year. The culminating peak of Ceylon is Pedrotalagala, about 20 miles north-eastward of Adam's peak, and nearly 900 feet higher. South-westward of Adam's peak there is much elevated country. The Haycock, (Hineduma kanda), nearly 20 miles northward of Point de Galle, is conspicuous from seaward off the south-western coast of Ceylon.

Soundings.‡—Off the south-west coast of Ceylon, the bank of soundings extends less than 15 miles; northward of Colombo, to only about 10 miles; and to not more than half that distance off Kalpentin and Kara-Tivo. From the latter place the edge of the bank trends north-west towards Pámbam, and at 15 miles south of that town there is no bottom at 100 fathoms. The continuation of the bank, off the Tinneveli coast to cape Comorin, has not yet been examined; its outer edge cannot be correctly defined, but due south of cape Comorin it stretches 45 miles off shore. Depths of 1770 to 1850 fathoms were found by H.M. Surveying vessel *Flying Fish*, in 1887, on the reported position of Behar bank, 57 miles westward of Point de Galle.§

* See pages 427, 439, for monthly statement of current sand winds on the coast of Ceylon.

† See Admiralty charts:—Cape Comorin to Cocanada, No. 823, scale $m=0.05$ inch; Gulf of Manár, No. 68b, scale $m=0.24$ inch; and South coast of Ceylon, No. 813, scale $m=0.25$ inch.

‡ In 1874 a bank, several miles in length with 12 to 16 fathoms over it, was reported by the French transport *Avrejon* about 13 miles westward of Point de Galle; and, in 1879, the French corvette *Victorieuse* found $9\frac{1}{2}$ and 12 fathoms near the position indicated.

§ Behar bank has been expunged from the Admiralty charts.

Between Colombo and Galle the soundings at the edge of the bank are mostly less than 30 fathoms, deepening as much as 10 fathoms farther in shore. Vessels in this locality, and uncertain of their position, should not approach the land at night, after soundings have been once obtained.

Between Colombo and Galle, vessels should keep about 5 miles off shore during daylight, some of the outer dangers on this coast lying 3 miles from the coast.

Approach to Colombo.*—Westward of Colombo the bank of soundings extends off about 10 miles, with depths less than 30 fathoms immediately within its edge. North-westward of Colombo, about 2 miles within the 100 fathoms line, is a narrow coral bank, lying parallel to the shore, with 11 to 15 fathoms on it, the depths increasing 3 to 6 fathoms to the eastward of the bank. The coast about Colombo is low, fringed with cocoa-nut trees, and not visible more than 10 miles from seaward.

The lighthouse, which is also the clock tower, All Saints church spire (the only spire) and the black dome of the Dutch church are the most conspicuous marks. The flagstaff is about 200 yards to the north-west of the lighthouse. When making the port from the southward, mount Lavinia white house is a useful object for identifying this part of the coast. In the north-east monsoon, Adam's peak, which has been seen at a distance of 90 miles, may be useful as a mark for approaching Colombo from the westward.

COLOMBO.—LIGHTS.—A *group flashing white* light, showing *three flashes* in quick succession every *thirty seconds*, each flash lasting *two seconds*, separated by an eclipse of *three seconds*, and followed by an eclipse of *eighteen seconds*, is exhibited from the clock tower standing in the centre of the Fort. The light is dioptric, of the first order, elevated 135 feet above high water, and is visible in clear weather at a distance of 17 miles.

From a lighthouse on the extremity of the breakwater, is shown a *fixed red* light, elevated 56 feet above high water, which should be visible in clear weather from a distance of 12 miles.

Harbour Lights.—A *fixed green* light is shown from the west end of the coal depôt; a *fixed red* light is shown inshore of the *green* light. These lights should be visible in clear weather from a distance of about 3 miles, and are not seen until a vessel is eastward of the

* See Admiralty plan of Colombo harbour, No. 914, scale $m=10\cdot4$ inches; and plan of Colombo harbour on chart No. 813.

line of the breakwater; kept in line bearing S. 6° W. (or parallel with the direction of the breakwater) they lead midway between the second and third lines of buoys.

A *fixed red* light is also shown from the extremity of the landing pier.

PILOTS.—A pilot-boat, displaying a jack on a staff in the bow, boards vessels, except native craft, standing for the port, about one mile outside the breakwater. Pilotage is compulsory for all merchant vessels above 200 tons. At night, pilots board steamers showing a blue light, but not sailing vessels. The pilot boat shows a flare-up light occasionally, after rounding the end of the breakwater.

Night Pilot Signals.—The following signals are shown at night from the Pilot's look-out tower, near the flagstaff, in answer to signals for a pilot made by vessels approaching the harbour.

One blue light :—signifies that the pilot on night duty is disengaged, and will proceed at once to the vessel making the signal.

Two blue lights, in succession, with a short interval between :—that a pilot is engaged with another vessel, and may be delayed some time in getting out to the vessel making the signal.

Three blue lights in succession, with a short interval between :—that a pilot will not go out, the weather being too bad for safely boarding a vessel at night; an event, however, which seldom happens. Under such circumstances a vessel should either anchor well out, or keep underway until daylight.

DANGERS.—**Drunken Sailor**, a ledge of rocks with 7 feet least water, bears W.S.W. from Colombo principal lighthouse, and lies nearly half a mile off shore. On this danger, during the south-west monsoon, the sea breaks, but not during the north-east monsoon, or with smooth water.

A **black buoy** is moored during the north-east monsoon, from October 15th to April 15th, about half a cable westward of Drunken Sailor. Vessels should always pass to the westward of this buoy.

Tartar rock, a sunken rock, with 21 feet water over it, lies about 6 cables northward of Drunken Sailor, and N.W. half a mile from the flagstaff.

A **red buoy** is moored about half a cable to the north-west of Tartar rock. Vessels should pass not less than half a cable westward of this buoy.

Tides and Currents.—It is high water, full and change, at Colombo at 1h. Springs range about 2 feet, and neaps only a few

inches. The current off the west coast of Ceylon is variable about the change of monsoon; during the south-west monsoon it sets to the northward, and when the north-east monsoon is fairly set in, from the end of November to the middle of February, it sets southward. Its strength is not more than one knot an hour.

Colombo roadstead, although exposed to the south-west monsoon, is safe for vessels well found in ground tackle, but since the completion of the breakwater it is seldom used, except by vessels seeking cargo. Communication between the shore and shipping is seldom interrupted, although there are occasional spells of squally weather and a high sea during the south-west monsoon.

Anchorage.—The anchorage outside Colombo harbour is with the lighthouse at the extremity of the breakwater bearing E. by S., and the principal lighthouse S.S.E. $\frac{1}{2}$ E., in 8 to 9 fathoms, good holding ground.

Ballast.—Vessels are not allowed to discharge ballast in depths under 12 fathoms near Colombo.

COLOMBO HARBOUR is sheltered from the south-west monsoon by the breakwater, within which there are moorings for vessels of any size.

The Breakwater, the foundation stone of which was laid by H.R.H. the Prince of Wales on the 8th December 1875, is carried out from near Customhouse point in a N. $\frac{1}{4}$ E. direction for about three-quarters of a mile. The breakwater encloses an area of about 500 acres, which is being dredged to a depth of 28 feet at low water. Vessels of 28 feet draught can enter at high-water neaps, and a few berths are available for vessels of that draught; the heaviest draught vessel that has visited the port (1891) was of 26 feet 6 inches draught. It is proposed to build a breakwater from Mutwal point towards the extremity of the existing breakwater, leaving an entrance 600 feet in width between the pier heads.

Moorings.—Three lines of moorings, with six buoys about one cable apart, in each, and one tier of two buoys, are laid down parallel to the breakwater, affording 20 berths for large vessels. Vessels are berthed by pilots between the buoys, head to northward during north-east monsoon, when the spaces between each tier of buoys serve as channels up and down the harbour; and head to westward during south-west monsoon, when the space between the second and third

tier of buoys from the breakwater is reserved as the channel, for which at night, the red and green leading lights in one, serve as the leading mark. Pilots berth all vessels.

DIRECTIONS.—Vessels approaching from the westward should bring the lighthouse at the extremity of the breakwater, or *red* light, to bear E. by S., and then steer towards it. From the southward, when near Colombo, keep about 2 miles off shore, or in a greater depth than 14 fathoms, until the breakwater light bears eastward of N.E. by E., when Tartar rock will be passed, and course may be altered to the eastward. The signal for a pilot should be made when about 3 miles from the port, but at night a vessel should stop in the position recommended for anchoring in the roadstead, if not previously boarded by the pilot. Sailing vessels are not taken into the harbour at night, and should anchor in the roadstead until daylight. *See Night Pilot Signals, page 46.*

Colombo, the capital of Ceylon, has two quarters, the part known as the Fort, inhabited by the officials and merchants, occupying the point southward of the breakwater; and the portion inhabited by Sinhalese, Muhammedans, and Tamils, stretching along the shore eastward of the harbour. The streets are lined with avenues of hibiscus and other trees. The population of Colombo is about 120,000.

Communication.—Steam, Railway, Telegraph.—Colombo has weekly communication with the United Kingdom and Australia by the mail steamers of the Peninsula and Oriental, and Orient companies, the services alternating. The P. and O. Co. provide fortnightly steamers to and from Japan, China, Straits Settlements, Calcutta, Madras, Colombo, and Bombay. There is communication by several other lines of steamers with Europe, India, Australia, and China. Colombo is connected by railway with Kandi, about 60 miles to the north-eastward; and Kaltura, 25 miles to the southward. By telegraph, with the Indian system, and Galle, Kandi, Trincomali, Batticaloa, &c., in Ceylon.

Supplies.—Fresh water is brought alongside in tanks. Beef, mutton, and vegetables can be obtained in any quantity, and are of moderate price.

Coal.—About 100,000 tons are kept in stock. It is shipped in bags, from lighters of 15 to 20 tons capacity, with rapidity, and bad weather causes no interruption; about 100 tons per hour can be placed on board.

Repairs.—Large repairs can be executed, boilers of any size repaired, shafts of 9 inches diameter forged, cylinders of 60 inches diameter cast and bored, and engines of any size repaired. The crane on Government wharf, which has a depth of 4 feet alongside at low water, has a lifting power of 15 tons.

Time Signal.—A time signal is made daily, except on Sundays and public holidays, at a flagstaff adjoining the Master Attendant's office. The signal is a red and white semaphore, inclined at an angle of about 45° as preparatory at five minutes before signal, placed horizontally at two minutes before, and dropped at 4h. 15m. p.m. Colombo local (Round tower flagstaff) mean time, equivalent to 22h. 55m. 38.04s. Greenwich mean time.

Position.—The Master Attendant's flagstaff is situated in lat. $6^{\circ} 56' 34''$ N., long. $79^{\circ} 50' 34''$ E.

Trade—Shipping.—The chief exports are tea, coffee, chinchona, cocoanut oil, coir, &c. ; the imports, grain, spirits, wine, sugar, tobacco, cotton manufactures, &c. ; all of an aggregate value in 1890 of Rs.114,219,278. The port was entered in that year by 2,395 vessels of 2,739,029 collective tonnage.

Quarantine.—Vessels with an infectious disease on board, or having occurred on board within 10 days previous to arrival, are placed in quarantine, for a term to be decided by the principal civil medical officer.

Hospital.—Seamen are admitted to the general Hospital at Marandana. There is no sailor's home at Colombo.

Winds and Climate.—A moderate gale of wind is sometimes felt at Colombo about the change of monsoon in May or June, or November, and occasionally in December. In January the north-east monsoon is at its height, and from noon to sunset the "alongshore" wind, dry and considered unhealthy, is experienced. Towards the end of the month slight showers fall. February is dry, with hot days and cool nights. Land and sea breezes set in towards the end of the month. In March there are squalls off the land, with thunder storms in the evening. In April land and sea breezes prevail ; about the middle of the month south-west winds usually blow for a few days, this is known as the little monsoon ; a ground swell from the south-west sets in at the end of the month. About the middle of May the south-west monsoon begins with a burst, which is violent for a few hours, but soon settles down into a steady wind with copious rain. In June the monsoon is stronger, and in July more

moderate again, with the rainfall abating in quantity. August and September are fine with light westerly winds. October is more unsettled, with the wind inclined to the northward. Early in November the wind is north-west by day and north-north-east at night, and about the middle of the month the north-east monsoon begins with more or less disturbed weather, and heavy rain again falls. In December the monsoon is steady and moderate, and the "alongshore" wind is felt.

The following table is the result of observations taken at Colombo at an elevation of 40 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		M an.	Cloud. Mean.	Ins.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	79	86	72	14	21	74	4·9	3·0	6	29·88	·12
February - -	80	87	73	14	22	73	4·2	1·7	4	—88	·13
March - -	82	88	75	13	18	76	4·7	5·5	9	—87	·13
April - -	83	89	77	12	18	77	5·6	8·8	13	—82	·12
May - -	83	87	78	9	18	79	6·8	13·2	20	—81	·10
June - -	82	85	78	7	14	81	7·6	8·2	17	—82	·08
July - -	81	85	77	8	14	80	6·8	5·5	12	—83	·08
August - -	81	84	77	7	13	80	7·0	4·5	13	—84	·09
September -	81	85	77	8	13	80	6·9	4·9	14	—86	·11
October - -	81	85	76	9	15	80	6·8	12·9	21	—86	·11
November -	80	85	74	11	16	79	6·2	12·7	17	—86	·11
December -	80	85	73	12	19	76	5·9	6·4	13	—87	·12

✓ **Mount Lavinia** is a rocky headland 6 miles to the southward of Colombo. On it is a conspicuous white building. A narrow rocky bank, 2 miles in length, with one fathom water, lies along the shore southward of the mount. Abreast of mount Lavinia, the 10 fathoms line is less than half a mile from the coast. Southward of Colombo, along the shore, lies the suburb of Kolpetti, with its numerous villas. The open space south of the fort is called the Galle-face.

PANTURA.—This large town, 8 miles southward from mount Lavinia, is at the mouth of a river which flows from Pántura lake. On the south side of the entrance, are two rocks above water, surrounded

by others under water ; the outer, Gonagala rock, is nearly one mile W.S.W. from the town, and has a depth of 8 fathoms close outside. The anchorage is W.S.W. of these rocks in 10 or 12 fathoms, nearly 2 miles off shore ; and in approaching it care must be taken to avoid the Nilkete and other rocks to the southward. A high tree stands behind the cocoa-nut trees, $2\frac{1}{2}$ miles northward of Pántura, and nearly one mile from the beach. About 2 miles W.N.W. from this tree, and half a mile off shore, is a rocky bank of 3 fathoms, about one mile in length, opposite the village of Digorella.

Nilkete rock, with a depth of 2 fathoms, is situated about $1\frac{1}{2}$ miles from the nearest shore, and 2 miles south-west of Pántura.

A rock, with 4 fathoms over it, lies W.N.W. half a mile from Nilkete rock. Two small rocks, with depths of 3 fathoms, lie S. by W. about 3 cables from Nilkete rock.

Kaluwattegala rock with a depth of $3\frac{1}{2}$ fathoms, lies about $2\frac{1}{2}$ miles off shore, with Káltura fort S.E. $\frac{3}{4}$ E., and Pántura N. by E.

Veyangula rock, with $5\frac{1}{2}$ fathoms on it, lies W.N.W. about 6 cables from Kaluwattegala rock.

Desaster rock, off a village of that name, stands close to the shore about $1\frac{1}{4}$ miles to north-west of Káltura fort ; there are sunken rocks both to north and south of it.

The COAST between Pántura and Káltura is low and sandy, and abundantly planted with cocoa-nut trees. A canal joins these places and Négombo. Near this part of the coast caution should be used, and the soundings not be shoaled to less than 20 fathoms.

Uheli reef, formed of coral, and about three-quarters of a mile in length, has depths of $3\frac{1}{2}$ to 4 fathoms. The least water is at its southern end, from whence Káltura fort bears E. $\frac{1}{4}$ N. distant $2\frac{1}{4}$ miles.

Two-fathom rock lies one mile off shore, and $1\frac{3}{4}$ miles S.W. $\frac{3}{4}$ S. from Káltura fort ; it has a depth of 12 or 13 feet on it, and does not break, except in such bad weather as would forbid a ship communicating with Káltura. Another rocky patch, with 3 fathoms water, lies S. by E. $\frac{3}{4}$ E., 2 miles from Two-fathom rock, and $1\frac{1}{4}$ miles northward of the high rock, called Nawoellikandi.

Nawoellikandi rock is high, and situated one mile offshore, $4\frac{1}{2}$ miles southward of Káltura ; a sunken rock lies half a mile to the southward.

KÁLTURA FORT, on the east bank of Kalu Ganga river, and about three-quarters of a mile N. by E. from its entrance, is 8 miles

southward of Pántura. The land on which the fort stands is slightly elevated; a sandy shore extends from Káltura to Maguna point, $1\frac{1}{2}$ miles north-eastward of which is Beach hill. Káltura is now a considerable town and is connected with Colombo by railway, and with Galle by a daily coach.

DIRECTIONS.—A vessel approaching Káltura should keep about 5 miles offshore until the Fort bears E.N.E., or is in line with Adam's peak, if it is visible; which mark or bearing leads between Uheli reef and Two-fathom rock. Vessels anchor in 5 to 6 fathoms about one mile from the entrance of the river.

Fanny rock, with 4 fathoms water on it, and 13 fathoms close around, lies with Barberyn island bearing E. by S. $\frac{3}{4}$ S. $2\frac{3}{4}$ miles, and Beach hill N.E. by E. About $1\frac{1}{4}$ miles N.W. by W. from this rock is a patch of 7 fathoms.

Barberyn island, standing about 2 cables off the main land, to which rocks connect it, is 7 miles southward of Káltura, and may be recognised by its lighthouse. There is anchorage northward of it in 6 or 7 fathoms; and a small bay farther in, with 2 fathoms, sandy bottom, where small craft may anchor.

LIGHT.—A *flashing white* light, showing a quick flash *every minute*, elevated 150 feet above the sea, and visible 18 miles in clear weather, is exhibited from a circular white lighthouse, 103 feet high, erected on the summit of Barberyn island.

Mana Golla rock, with a depth of $3\frac{1}{2}$ fathoms, lies with Barberyn island E.S.E., three-quarters of a mile. Goda Golla and Rama Cate rocks, with 4 and 5 fathoms on them, lie between Mana Golla and Barberyn island.

Bentotti river entrance is 3 miles south of Barberyn island; the town of Bentotti is on the south bank, and half a mile from the bar, on which there are only 3 or 4 feet water, but the depth varies according to the season, being greater after heavy rains, when the bar becomes navigable for the native coasting craft. In the river there is a depth of one to 2 fathoms. As the sands on the bar frequently shift, and there is generally a surf, boats should not attempt to cross it without a pilot.

Udapitta point, on the south side of entrance to Bentotti river, is rocky and of moderate height, with Andevan rocks lying half a mile W.N.W. from it. There are several sunken rocks, with 3 to 4 feet water on them, between Andevan rocks and Udapitta point.

Unapayagalle point, $3\frac{1}{2}$ miles southward from Udapitta point, is low and rocky, and continues so for one mile in a southerly direction to Nyakandugalle point, but between this last and Kosgoddi hill the shore is sand.

Dodompapa rocks, showing above water, are half a mile north-west from Unapayagalle point; between these rocks and Udapitta point, at less than half a mile offshore, lie several other rocks with from 3 to 6 feet water on them; and a quarter of a mile north-west from Dodompapa rocks is a depth of 2 fathoms.

Utari bank.—**Kerevanni rock**, a small white-topped rock, stands a quarter of a mile south-west from Unapayagalle point; and one mile west from this rock is the north extreme of Utari, a rocky bank having a depth of 4 to 5 fathoms, extending southward till within half a mile seaward of Napa rock.

Napa rock, lying $2\frac{3}{4}$ miles southward of Unapayagalle point, and one mile off shore, has 2 fathoms water on it, and 8 fathoms close outside; it forms the northern extreme of Konda bank, which extends southward to half a mile inshore of Alut rock.

Cabravanna rock, above water, is situated close to the coast 4 miles southward of Unapayagalle point. The shore near, is low and rocky, and forms the southern extreme of some cliffs half a mile in length; the northern end is higher and called Kosgoddi hill. A house, on the cliff near Cabravanna rock, is conspicuous from seaward.

Alut rock, with only 8 feet water on it, and deep water around, lies $1\frac{1}{4}$ miles west from Cabravanna rock. Gindavana islet well open westward of Myimba rocks, about S.E. $\frac{1}{2}$ S., leads westward of Alut rock.

Balapitti river, $2\frac{1}{4}$ miles southward of Cabravanna rock, is small, and navigable only by boats. On the northern side of the entrance is a custom house. The coast northward of the river is low and sandy; Balapitti Modere point, the southern entrance point, is rocky and slightly elevated. Myimba rocks, above water, lie half a mile westward of the river mouth, and are surrounded by a reef. Several sunken rocks lie within half a mile of the coast near Balapitti river.

Wathu bank, having a depth of 3 fathoms, is about one mile southward of Myimba rocks, with which it is apparently connected by a bank having a depth of 5 fathoms on it.

Gindavana islet, nearly 3 miles southward of Balapitti river, and a quarter of a mile offshore, is rocky, and of moderate height. Amblangoddi rest-house, a conspicuous building from seaward, stands on the summit of a rocky cliff, half a mile south-eastward of Gindavana; close to the southward of the rest-house is an opening in the rocks forming a cove, with a sandy beach about 100 yards in extent, and anchorage for boats in $2\frac{1}{2}$ fathoms water. A small river has its mouth to the south of Amblangoddi, and off it are several rocks. Off Patiagalle point, which is three-quarters of a mile S.E. by S. from Gindavana islet, is a rock called Radul. White coral is found on this part of the coast, and shipped to Colombo and Point de Galle, where, when calcined, it forms lime used for building purposes.

Akoráli point, 5 miles S.S.E. from Balapitti river, is low, sandy, and covered with cocoa-nut trees.

Passi rock is small, and above water, with a bank, on which the sea breaks heavily, extending from it about 2 cables to the southward; from Passi rock Akorali point bears E. by N. $\frac{1}{2}$ N. $1\frac{1}{10}$ miles. A sunken rock is reported to exist half a mile W.S.W. of Passi rock; and another rock is said to lie 3 or 4 cables northward.

Tung and Vatang rocks lie near the coast off Akoráli point, and the ground in that vicinity is generally foul.

Senegammi point, $2\frac{1}{2}$ miles south-eastward of Akoráli point, is low and rocky. Debaha rock, a few feet high, and divided into two parts, lies half a mile south-west of Senegammi point.

Waal point, 2 miles further south-eastward, is low and covered with cocoa-nut trees. Off it lies Waal islet, high and rocky, with smaller islets near. The village of Hikadowi is midway between Senegammi and Waal points; a gap in the reef, which here fringes the coast, affords a passage for small boats to the anchorage off the village.

Dodandowi, a village with a custom-house, on a small river, is $2\frac{1}{4}$ miles south-eastward of Waal point; the river entrance is north of the village, and has two rocky islets off it, at less than one cable from the sandy shore; the northern islet called Medda, affords some shelter from southerly winds to the landing place at the river's mouth. Manda, the southern islet, is on the shore reef, and one cable from Medda, and bears N.W. $\frac{1}{2}$ W., $7\frac{1}{4}$ miles from Point de Galle lighthouse.*

* See plan of Dodandowi bay on chart. No. 913; scale, $m=3$ inches.

Dangers.—**Hikodi rock**, the outermost danger in Dodandowi bay, lies nearly $1\frac{1}{4}$ miles W. by N $\frac{1}{2}$ N. from Medda islet; it is small, has 6 feet water over it, and deep water all round. Half a mile inshore of it, lies Un reef, with many rocks between it and the coast. Debaha rock, well open westward of Waal islet, leads westward of Hikodi rock; and Medda islet bearing East, leads southward.

Dodandowi rocks, always breaking, lie a quarter of a mile W. by N. from Manda; Orava rock, with 6 feet water on it, is situated one cable N.N.W. $\frac{1}{4}$ W. from Dodandowi rocks; vessels should pass westward of both these dangers when entering or leaving Dodandowi anchorage.

Godda bank, with rocky bottom, and 4 fathoms least water, lies S.W. $\frac{1}{2}$ W. nearly 2 miles from Dodandowi point. Senegammi point, just open westward of Waal islet, leads inside Godda bank.

Anchorage.—Dodandowi outer anchorage is in 6 or 7 fathoms, sand, 2 cables north-westward of Medda rock; and with Dodandowi rocks about S.S.W. Small vessels may anchor farther in about one cable northward of Medda rock.

Tides.—It is high water, full and change, at Dodandowi bay at 1h. 50m.; ordinary springs rise $1\frac{1}{2}$ feet.

Gindura river is nearly midway between Manda islet and Point de Galle; to the north-west of the river entrance the coast is low and sandy, to the south-east it is rugged and rocky. From Waal point to Point de Galle the land near the coast has a level appearance, and is covered with cocoa-nut trees.

Caution.—Sailing vessels approaching Point de Galle harbour should be careful to keep a weatherly position to enable them to sail in, and it should be borne in mind that the current sets along the line of coast with great velocity, to the east during the south-west monsoon, and to the west during the north-east monsoon. Vessels during the south-west monsoon, by getting to leeward of the port, have taken weeks to regain their lost ground, and in some cases have been compelled either to bear up for Trincomali, or to recross the equator.

POINT DE GALLE HARBOUR* is formed between Point de Galle and the sloping land eastward, on the summit of which, 264 feet high, stands Edward's pillar, about 50 feet in height; thence

* See Admiralty charts, Point de Galle harbour, No. 820; scale, $m = 11\cdot8$ inches; Approaches to Point de Galle harbour, No. 819; scale, $m = 3$ inches, and Indian ocean, Ceylon, south coast, No. 813; scale, $m = 0\cdot25$ inch.

the land trends to the south-east, terminating in Unawatti point, which is steep, rocky, and wooded, with a clump of trees on it, conspicuous from seaward. Watering point, upon which stands a white tower, is a rocky bluff a little more than a mile E. by S. $\frac{1}{2}$ S. from Point de Galle, and forms the eastern limit of the harbour. The actual entrance is narrowed, and the anchorage within much confined by numerous dangerous reefs, having only from 3 to 15 feet water over them. At the head of the harbour is a low sandy beach bordered with cocoa-nut trees. Near the centre are two rocky promontories known as Gibbet island and Glosenburg. The anchorage frequented by shipping is in from 6 to 4 fathoms sandy bottom, on the west side of the harbour, abreast the fort. The land in the vicinity of Point de Galle is comparatively low and ill-defined, but the position of the harbour may be readily known by the lighthouse, which stands at the west point, and Edward's pillar to the eastward. On this point the fort and town are built, the sea front being rendered inaccessible by a line of coral reefs, on which the sea breaks heavily. The principal difficulty for sailing vessels arises from the strong currents which run east or west (according to the monsoon) past the submerged outer shoals.

Point de Galle harbour is considered a safe place in all seasons of the year, but with strong south-west winds a ground swell tumbles in; it is frequented as a port of call for orders, having telegraphic connection with India, Europe, China, and Australia.* The population of Point de Galle municipality in 1891 was 33,505.

Soundings.—The bank of soundings extends about 12 miles south-westward of Point de Galle, and sailing vessels may anchor on it in less than 40 fathoms, with a stream or kedge, should the wind fail and the current be unfavourable. Gallehogalle bank, bearing S.W. by W., 3 miles from Point de Galle, has depths of 16 to 22 fathoms on it.

Aspect.—The Haycock, a conical mountain, 2,160 feet high, situated N. by E. $\frac{3}{4}$ E., 19 miles from Point de Galle lighthouse, is conspicuous from the offing. Adam's peak may also be seen in clear weather.

The land westward of Point de Galle is generally low, with cocoa-nut trees near the sea; to the eastward it is formed of several ridges of hills of various heights.

* Galle was the *Kalah* of the early Arabians, and is the locality of the *Turkish* of Scripture. (Sir E. Tennent on Ceylon, vol. 2, p. 100.)

Draught of vessels.—Point de Galle harbour is available at all times to vessels of $24\frac{1}{2}$ feet draught. The deepest draught vessel that has visited the port was of $24\frac{1}{2}$ feet draught.

LIGHT.—A *flashing white* light, showing a *double flash every half minute*, the flashes being of *two seconds'* duration each, with an interval of *three seconds* between them, is exhibited from an iron tower, 80 feet high, and painted white, on the south bastion of the fort on Point de Galle; the light is 100 feet above sea level, and visible in clear weather from the distance of 12 miles.

Signal Station is on Neptune battery, about a quarter of a mile north-westward of Point de Galle lighthouse.

Pilots.—Merchant vessels should not proceed northward of Outer Kadda rock without a pilot. Usually, the pilot canoe, carrying a flag (white, red, white, horizontal), awaits a vessel outside the Kadda rocks. Bad weather may, however, prevent the boat from leaving the harbour, in which case the directions (*see* page 60) should be closely followed.

OFF-LYING DANGERS.—**Gindura rock.**—This rock, called Medda by the natives, lies W. by N. $\frac{1}{4}$ N. nearly $4\frac{1}{4}$ miles from Point de Galle lighthouse. From its shoalest part, which has only 6 feet water, and is very dangerous, as the sea does not always break over it, Haycock mountain appears a little to the left of the small white-topped Gull rock, one mile north-west of Gindura town; there are depths of 4 and 5 fathoms around Gindura rock at about two-thirds of a cable from it, and 15 fathoms at two cables outside of it. A small coral patch, of 3 fathoms, lies 7 cables N.E. by E. $\frac{1}{2}$ E. from it. The channel within Gindura rock should be avoided. To pass outside Gindura rock, vessels approaching Galle from the north-westward, should keep Akorali point westward of Waal islet, until Edward's pillar is open southward of Point de Galle lighthouse.

Buoy.—An iron nun buoy, painted *red*, and surmounted by a flag, lies in 11 fathoms, about 2 cables southward of Gindura rock.

Caution.—Too much reliance must not be placed on the buoys marking the outer dangers off Point de Galle, as they are liable to break adrift.

Whale rock, under water, bears W. $\frac{3}{8}$ N. $2\frac{1}{2}$ miles from Point de Galle lighthouse, and is $1\frac{1}{2}$ miles from the nearest shore; it always breaks, but in fine weather only about once in five minutes, so that a good look-out is necessary. There is no safe channel inside of it, the bottom being rocky, and the soundings irregular. A shoal lies

about midway between Whale rock and the shore, with $3\frac{3}{4}$ and $4\frac{1}{2}$ fathoms on it, and there are many shoal spots within half a mile of the coast. There are 7 fathoms close outside Whale rock, and 20 fathoms at less than half a mile off.

Buoy.—A conical red buoy is moored about 3 cables S.S.W. from Whale rock.

Little Whale rock (Grampus) is a small rock above water, lying about half-way between Whale rock and Point de Galle lighthouse. There are many rocks inside of it, with from 3 to 6 feet water on them. Kadra wella, a small bank, with a depth of 8 fathoms, lies about 3 cables south-east of the Little Whale.

Bellows rock lies S.S.E. $\frac{1}{2}$ E. about 6 cables from Unawatti point. The sea always breaks on this rock, very heavily in bad weather. There are several rocks between it and Unawatti point.

Luna Horowa rock, with a depth of about 18 feet on it, lies S.E. $\frac{1}{4}$ S. about $1\frac{2}{3}$ mile from Unawatti point.

Kadda rocks consists of three disconnected patches, Outer, Middle and Inner Kadda rocks, the whole 2 cables in extent, N. by E. and S. by W., with only 12 feet on the shoalest part. There is deep water between the rocks. During the south-west monsoon, heavy breakers extend the whole length of the rocks; but in the north-east monsoon there is seldom a break.

Outer Kadda, the southernmost, on which the least water is 13 feet, lies S. by E. $\frac{3}{4}$ E. about two-thirds of a mile from Point de Galle lighthouse, with the white mark on the east side of Point de Galle harbour almost shut in with Watering point.

Alut ground, on which the depth is 7 fathoms, lies S.E. by E. $\frac{1}{4}$ E. half a mile from Outer Kadda rock.

Buoy.—A bell buoy is moored about half a cable south-eastward of Outer Kadda rock.

Para rock, with a depth of 5 fathoms on it, lies $2\frac{1}{2}$ cables E. by N. from Outer Kadda rock.

Inner Para rock, with a depth of $4\frac{1}{2}$ fathoms on it, lies three-quarters of a cable N.E. by N. from Para rock.

Inner dangers.—There are so many sunken rocks in Point de Galle harbour, that a detailed description of them all will not be given. Their exact positions, and the depths of water on them, may be better ascertained by reference to the chart.

On the western side of the entrance to the harbour, Mimattia rock is situated midway between the Kadda rocks and the islets

off the lighthouse. Northward of Mimattia the rocks bordering the western side of the channel are Polkatti, Bellikatua and Kapera rocks, and Vellikoko reef. On the eastern side of the entrance, Imburinha rock lies W. by N. $\frac{3}{4}$ N. $2\frac{1}{2}$ cables from Watering point; on the eastern side of the channel within, are Deumba Dava rock, Matamada, Wara, and Kata rocks. Avaria rock, with 5 fathoms on it, lies in the channel to the anchorage. Tanna and Aan rocks lie westward and north-westward of Gibbet island. Ketti, Kabira, Miamé and Bokolosava rocks are in the eastern bay of the harbour.

Gull rock, about 3 feet high, and small, lies 2 cables N.E. from the landing place. Linne rock and Kasambera rock are northward and north-eastward of Gull rock. A wreck lies near Kasambera rock.

Buoys.—On the western side of the channel, a black buoy is moored eastward of Polkatti rock, and a small black conical buoy eastward of Bellikatua rock. A spherical black buoy lies eastward of the foul ground extending eastward of Utrecht bastion. A black buoy is moored eastward of Kapera rock, and another black buoy eastward of Vellikoko reef.

On the eastern side of the channel, a buoy, painted black and white in vertical stripes, is moored south-westward of Deumba Dava rock. A red buoy is moored westward of Mata mada rocks, and another red buoy westward of Kata rocks.

Outer anchorage.—In clear weather, the Haycock in line with Point de Galle lighthouse, N. by E. $\frac{3}{4}$ E., will lead to the outer roadstead. During the north-east monsoon the best anchorage off Point de Galle is in 16 fathoms, with the Pilot tree and lighthouse in line; and the rocks off Unawatti point on with Ereminia Galle. The Pilot tree (not very conspicuous) is situated on Mudlia hill, which is 157 feet high, and nearly a mile northward of the lighthouse; Ereminia Galle, upwards of one mile E.S.E. of Unawatti point, is a bluff point crowned with cocoa-nut trees. In the south-west monsoon, vessels should not anchor in the road, but should they be compelled to do so, the best temporary anchorage will be in the same depth of water, with the lighthouse bearing N.E., distant about $1\frac{1}{2}$ miles.

Tides.—It is high water, full and change, in Point de Galle harbour, at 2h.; springs rise about 2 feet. The tidal streams are very weak.

DIRECTIONS.—Vessels should not approach the coast north-westward of Point de Galle, as it has never been properly surveyed, and rocks may exist that are not marked on the charts.

No vessel, unless well acquainted with the locality, or compelled to seek refuge, should attempt to enter Point de Galle harbour without a pilot. (*See* page 57.) During the north-east monsoon (from December to March inclusive) the harbour is at all times accessible to sailing vessels, and anchorage can be easily reached; for a sea breeze varying from south-south-east to west, generally prevails during some part of each day. Early in the morning the wind is generally off the land from northward, and enables sailing vessels to leave the harbour. During the south-west monsoon (from April to November inclusive), though the wind frequently veers round even to northward of west, there is generally a heavy swell setting directly into the mouth of the harbour from the south-west; this sometimes occasions difficulty in bringing a vessel up in an anchorage so confined as to compel vessels to be moored by means of stern hawsers, which, if required, are supplied by the local authorities.

Approaching the harbour from westward.—By bringing Point de Galle lighthouse to bear E. by N., a vessel will pass clear to southward of Gindurá, the Whale, and Little Whale rocks. The rocky islets off the lighthouse may be approached in safety so long as the church in the fort (not now very conspicuous, but it may be identified as being close westward of a tower), or the Pilot tree, is kept to westward of the lighthouse; here the pilot's boat will generally be found.

Vessels requiring a pilot should heave to with the lighthouse bearing from N.E. to N.N.E., distant about one mile.

West entrance.—In the south-west monsoon the passage north-west of Kadda rocks is only used in case of urgent necessity. To pass north-westward of Kadda rocks, bring Edwards pillar in line with the white tower on Watering point E. $\frac{1}{4}$ N.; this will lead between Mimattia rock and Inner Kadda rock. Proceed with this mark on, until the Roman Catholic church (N.N.W. $\frac{1}{3}$ W., three-quarters of a mile from the lighthouse) comes in line with the lighthouse; then steer about N.E. by E., or halfway between Glosenburg and Gravet point (the termination of the high land in the north-east part of the harbour), until the flag-staff on Neptune bastion is in line with the lighthouse, N.W. $\frac{1}{4}$ W. Thence alter course to N. by E. $\frac{1}{2}$ E. for the police station at the head of the bay, proceeding in mid-channel between the black buoy of Polkatti and the red buoy of Mata mada. These buoys, with the others within, black on the port, and red on the starboard hand, entering from seaward, will then be

the guides. When the lighthouse is shut in with Utrecht bastion, anchor in about $5\frac{1}{2}$ fathoms one cable E.N.E. from Kapera buoy.

East Entrance.—To pass southward of Kadda rocks, keep Ereminia Galle open southward of Unawatti point, about E. by S., bringing this mark on while Pilot tree is westward of the lighthouse, and keeping it on until Pilot tree is open eastward of all the fortifications. Then steer about 2 cables to the north-eastward, hauling up for Pilot tree when it comes on with Polkatti black buoy. Stand on that line (about N. by W.) until the flag-staff and lighthouse are in line, then proceed as above directed, between the Polkatti and Mata mada buoys.

Coal.—About 40,000 tons of coal are kept in stock. It is shipped in bags from lighters.

Repairs.—Small repairs can be executed.

Supplies can be obtained.

Hospital.—Seamen are admitted to the Civil Hospital, which is commodious and built on a healthy site. There are no special quarantine regulations at Galle.

Trade.—The value of the imports in 1890 was Rs.4,249,078 and of the exports Rs.2,600,718. In that year Galle was visited by 534 vessels of 1,166,052 aggregate tons.

Communication.—Steam.—Telegraph.—The steam vessels of the British India Company afford fortnightly communication with all parts of the world *via* Colombo; and with the coast ports of India also every fortnight. Galle is connected by telegraph with Colombo, Trincomali and other ports in Ceylon, and with all parts of the world by the system of India.

Winds.—From observations taken at Point de Galle in 1890, calms appear to prevail on more than half the days in each month from November until April. The winds in that period are from all quarters, but north-westerly are most common. From May until October the wind blows almost without intermission from west and north-west.

THE SOUTH COAST* of Ceylon from Unawatti point eastward trends about E. by S., is low and woody with hills of moderate height inland, and so continues for about 12 miles to Belligam or Red bay. This part of the coast is steep and should not be approached under 30 fathoms.

* Chiefly from the remarks of Mr. T. H. Twynam, Master Attendant at Point de Galle in 1833.

Woody island, (Yakiniga Duwa), small, covered with trees, and fringed with coral reef, is situated about 9 miles eastward of Unawatti point, and a quarter of a mile from the shore. Close to the eastward of Woody island there is an opening in the reef affording anchorage for small coasting craft in from one to 2 fathoms, near the village of Goyapanná. A small rocky islet lies S.E. a quarter of a mile from Woody island, with which it is connected by coral reef.

About $5\frac{1}{2}$ miles eastward of Unawatti point, the reef which borders the coast projects more, and there is a passage through the reef leading to anchorage for boats in about 2 fathoms, off a village known locally as Kataloewi or Attadahowatti (Poloya Modere of the chart).

Vellivanni rock, $2\frac{3}{4}$ miles westward of Woody island, is only a few feet above water, and about a quarter of a mile from the shore, with depths of $3\frac{1}{2}$ and 5 fathoms close-to all round. On the beach about a mile westward of Vellivanni rock is a remarkable rock called Kotavanni or Kegalle stone.

Rasa Muna hill, or Rasa Muna Kanda hill, on the west entrance point of Belligam bay, has some red cliffs, and bears from Woody island E. by S. distant 2 miles. The land between is rugged, of moderate height, and covered with jungle, with an occasional clump of cocoa-nut trees, and lined with coral reef, having from 5 to 9 fathoms close-to.

BELLIGAM or **RED BAY**,* affording good anchorage in 5 to 6 fathoms, is about $1\frac{1}{2}$ miles wide at its entrance, and running in for the same distance has a semicircular shape. There are two small islands in the north-west part of the bay known as Gan and Pigeon islands. Gan island lies close to the beach, to which it is connected at low-water, off the village of Belligam. Pigeon island, of circular shape and about half a cable in extent, bears East, distant $4\frac{1}{2}$ cables from Gan island.

A reef projects from Rasa Muna hill point, on the west side of Belligam bay, for about 3 cables in an E.S.E. direction, and fringes the coast line of the west part of the bay as far as Gan island.

Godahalut rock, with one fathom over it, lies $4\frac{1}{2}$ cables S. $\frac{1}{2}$ E. from Rasa Muna hill point and is the south-western danger of Belligam bay.

Paas rock having 3 fathoms on it, lies $4\frac{1}{2}$ cables E.S.E. from

* See Plan of Belligam bay, scale $m=3$ inches, on Admiralty chart, No. 813.

Rasa Muna hill point, and Kadda rock ($4\frac{1}{2}$ fathoms) $9\frac{1}{2}$ cables in the same line of direction. Between these two rocks lies the entrance channel into Belligam bay.

Belligam point is situated about $3\frac{1}{2}$ cables N.E. by N. of Rasa Muna hill point, and there is a similar projection between.

Ruane or Ruana rock is small and quoin-shaped, and bears from Belligam point E. $\frac{3}{4}$ N., distant $2\frac{3}{4}$ cables.

Belligam village with a custom house and rest house at its southern end, extends along the shore of the bay near Gan island, and at a distance of about half a mile northward of Belligam point.

DIRECTIONS.—To enter, keep at least one mile offshore until Ruane rock is on with Gan island, when alter course and keep that rock and island in line until Vírumba rock, elevated about 10 feet above the water, and situated in the northern part of the bay, bears N. $\frac{1}{2}$ E., then steer towards it on that bearing, between Paas rock and Kadda rock; an anchorage may be picked up about 2 cables eastward of Ruane rock in 5 to 6 fathoms, sandy bottom. It is advisable not to stand too far to the northward of Ruane rock, on account of the foul ground extending about 3 cables south-east of Gan island, and between that island and Pigeon island.

Tides.—It is high water full and change, in Belligam bay at about 2h. 20m.; springs rise $2\frac{1}{4}$ feet.

Mirissi village is situated on the shore of a shallow bight in the south-east part of Belligam bay; close to the northward of it are some remarkable red cliffs.

Mirissi point, the east point of Belligam bay, is E. by S. $\frac{1}{2}$ S., $1\frac{1}{2}$ miles from Rasa Muna hill point. It is the north-west extreme of a rocky peninsula, presenting a range of cliffs to the sea of about three-quarters of a mile in extent, off the centre of which are several rocks above water, with foul ground a short distance outside them. A rocky ledge about $1\frac{1}{2}$ cables in extent, is situated 2 cables west of Mirissi point, the channel between having 6 fathoms of water.

Deumbahullet rock, with 9 feet of water, lies W. $\frac{1}{2}$ N., $3\frac{1}{2}$ cables, from Mirissi point.

THE COAST between Mirissi point of Belligam bay and Mátura trends eastward 7 miles, is moderately elevated, and densely wooded. Dondra head is 3 miles farther eastward. Tanana rocks, midway between Mirissi and Mátura, lie half a mile offshore. Off this part of the coast the bank of soundings extends less than 5 miles, and

there are no dangers more than a mile offshore. In the middle of the bight between Mátura and Dondra head there are some red cliffs, similar to those in Belligam bay, but more conspicuous, especially during the afternoon.

Madumora (Madamura) bank, having 3 fathoms on it and 8 fathoms outside close to, lies about a mile S. $\frac{1}{2}$ W. of Mátura river entrance, and three-quarters of a mile from the shore. It bears from Dondra head W. $\frac{1}{2}$ N., distant $2\frac{1}{2}$ miles.

Between Madumora bank and the entrance of Mátura river there are many rocks above and below water.

Madumora bank and all other dangers off Mátura and Dondra head may be avoided by keeping the highest part of the high land of Mirissi point well open of the land to the eastward of it.

Mátura, a considerable town with a fort, is the station of an assistant government agent. Situated in the bight westward of Dondra head, from which it bears N.W. by W. $2\frac{3}{4}$ miles, it is only conspicuous from seaward between the bearings of N.N.W. and N.E. Its position may be discerned by Pigeon or Mátura island, which resembles a haycock, and lies near the beach directly off it. Boats find shelter under Pigeon island, and the surf being generally high, canoes are used for passing to the mainland.

Mátura river, the entrance of which is about half a mile westward of Mátura fort, has several dangerous sunken rocks at its entrance, from which there is also a strong outset, rendering it necessary to employ natives as pilots if desiring to enter. Wood and fresh water may be procured in the river.

Anchorage, during the north-east monsoon, may be obtained abreast the town of Mátura, and 2 miles from the shore, in from 20 to 22 fathoms, with the red cliffs north-westward of Dondra head bearing N.N.E. $\frac{1}{2}$ E., bottom sand, shells, and ooze; under 20 fathoms the bottom is generally foul.

DONDRA HEAD, the southernmost point of Ceylon, is low, with a grove of tall cocoa-nut trees on its extremity, by which, and by its lighthouse, it may be known. Gongala, 4,445 feet in height, is 29 miles northward of Dondra head. The land along this part of the coast is generally of moderate height, formed of a diversity of hills, which become more elevated in the interior.

A reef, with depths from 3 to 5 fathoms over it, and upon which the sea sometimes breaks heavily, extends W. by S. three-quarters of a mile from the western extreme of Dondra head. Rajapolila rocks lie half a mile W.N.W. from Dondra head.

LIGHT.—A *flashing white* light, showing a quick flash *every twenty seconds*, elevated 150 feet above the sea, and visible 18 miles in clear weather, is exhibited from an octagonal white tower, 156 feet high, erected on the eastern extreme of Dondra head.

Gándura point is $1\frac{1}{4}$ miles eastward of Dondra head. The coast here is high and rocky, and lined with a reef. Henia rocks, above water, lie close to the coast, nearly half a mile westward of Gándura point. A rock having over it 3 fathoms lies close to Gándura point on the south side. The village of Gándura lies to the northward of the point at the bottom of a small cove, about a quarter of a mile in depth and $1\frac{1}{2}$ cables wide, having anchorage in 3 to 6 fathoms, sand and ooze, but exposed to the swell in the south-west monsoon.

Kapperawelli point, is $1\frac{1}{2}$ miles north-eastward of Gándura point, the coast between, forming Gándura or Galieo bay, being high, rocky, and lined with reef. Nuroni cove, having a sand beach and cocoa-nut trees, interrupts the rocky coast line of Gándura bay for about half a mile. Gull rocks or islets extend $1\frac{1}{2}$ cables eastward from Kapperawelli point, inside of which, in a sandy bight, is the village of Kotagoddi.

Etawa or Etala reef, nearly one-third of a mile in length in an E.N.E. and W.S.W. direction, lies E. $\frac{1}{2}$ N. nearly one mile from the east end of Kapperawelli point. The western extreme of Nuroni cove beach, open of the south-west extreme of Kapperawelli point, W. $\frac{1}{2}$ S., leads southward of Etawa reef.

Bambri rocks, nearly half a mile north-eastward of Etawa reef, are above water and connected by a reef with the shore.

Nilewelli point is $4\frac{3}{4}$ miles eastward from Kapperawelli point, the coast between being of moderate height, covered with jungle, with an occasional sandy bight and plantation of cocoa-nut trees. Dekwelli bay, half a mile in breadth, and rendered inaccessible by the reef extending across its entrance, is $1\frac{1}{2}$ miles westward of Nilewelli point. In this bay is a village, with rest house, and a plantation of cocoa-nut trees. Nilewelli point is rocky, of moderate height, nearly insulated, and has a remarkable clump of cocoa-nut trees, giving it the appearance of a table island when seen from the east or westward. It is connected with the mainland by a strip of sand over which the sea breaks. About a mile northward of Nilewelli point, and half a mile inland, is a conspicuous white pagoda.

Polonha point bears from Nilewelli point N.E. $\frac{1}{2}$ E. distant one

mile. Nilewelli bay, between Polonha and Nilewelli points, has high and rocky shores, but at the bottom of the bay is a sandy beach, lined by a reef, which extends half a mile from the shore.

Nilewelli village stands in a small bight on the west side of Nilewelli bay; and off the village is the best anchorage, in from 4 to 10 fathoms sand, but the bank is steep-to, and the anchorage confined.

Vessels anchoring here should take care to shut in Tangalle fort (to the eastward) by Polonha point, as outside this mark the ground is foul.

Mahawelli point, $1\frac{1}{2}$ miles north-eastward from Polonha point, is high, steep, and rocky, the coast between forming a bight at the bottom of which is Sureya Tree bay, small and sandy, where the coasting craft anchor in 3 fathoms, sand, close to the beach.

Mahawelli bay, having anchorage in 4 to 7 fathoms in its south-west part, lies immediately northward of Mahawelli point. Mahawelli rocks, small, and nearly awash, lie nearly a quarter of a mile E.N.E. from Mahawelli point; close to all round them is a depth of 8 fathoms.

Únaeria rocks or islets, nearly one mile E. by N. $\frac{3}{4}$ N. of Mahawelli point, have 7 to 9 fathoms close to on the outside. Middle rocks lie $1\frac{1}{2}$ cables W.S.W. from Únaeria rocks.

The passage into Mahawelli bay, about half a mile wide in 9 and 10 fathoms, lies between the Únaeria and Mahawelli rocks, keeping nearer to the Mahawelli rocks to avoid Middle rocks.

Tangalle point forms a gradual hill slope towards the sea and is $4\frac{3}{4}$ miles north-eastward from Polonha point; the coast between being of moderate height and generally rocky. A square fort and Cutcherry stands on its summit, by which it may be recognised from seaward. Kadul reef extends half a mile eastward from Tangalle point.

Tangalle rock, above water and steep-to, bears from Tangalle point E. $\frac{1}{2}$ S. distant one mile. Between Tangalle rock and the reef off Tangalle point is a passage having 5 fathoms of water, but obstructed by Kadul rock having 10 feet of water over it, which lies 2 cables N.W. $\frac{1}{2}$ N. from Tangalle rock. Ma rock, having 16 feet water, is situated N.E. $\frac{1}{2}$ N., 4 cables from Tangalle rock.

TANGALLE BAY, of considerable extent east and west but of no great depth, lies eastward of Tangalle point, and affords indifferent anchorage in 5 to 6 fathoms, sand, the bottom in Tangalle bay being

generally foul, and the anchorage exposed to the swell of the south-west monsoon. A reef commences about a mile north-eastward of Tangalle point, and lines the eastern side of the bay to a distance of one-third of a mile from the shore. The west side of the bay is low, with cocoa-nut plantations, amongst which is the town of Tangalle. The custom-house is on the west side of the bay, and the best landing place is near it.

Nakatta rock lies N.E. by N., 4 cables from the eastern extreme of Tangalle point.

DIRECTIONS.—Boats with flags are generally stationed on Kadul and Ma rocks when vessels are entering or leaving the bay. A stranger should pass half a mile south-eastward of Tangalle rocks and stand to the north-east until a small white pagoda (half a mile N.W. of the fort) is in one with the high cocoa-nut trees on the south-west bank of the outlet of Kunkalle river, about W. $\frac{1}{2}$ S., stand in with those marks in line, and anchor in 5 to 6 fathoms with Tangalle rocks bearing from S. by E. to S.E. by S.

Rakova point, sloping and barren and having a reef projecting a quarter of a mile from it to the southward, is the east point of Tangalle bay, and bears E.N.E. $3\frac{3}{4}$ miles from Tangalle point. Rakova rock, above water, is half a mile eastward of the south extreme of the point. Eastward of Rakova point the coast forms a bight lined with coral reef, having on its eastern side the village of Kahandawa with several clumps of cocoa-nut trees.

Kahandawa point, forming the eastern extremity of this bight, is sandy and of moderate height; it bears from Rakova point N.E. by E. $\frac{1}{2}$ E., distant $2\frac{1}{2}$ miles.

Kahandawa rocks lie three-quarters of a mile south-westward of Kahandawa point. The outer rock, just covered, lies E. by N. $\frac{1}{4}$ N., $2\frac{1}{2}$ miles from Rakova point. There are several rocks inshore of this, the inner, Kahandawa rock, above water, being on the edge of the shore reef, a quarter of a mile N.W. by W. from the outer rock.

Kalamatta point, high and rocky, with a chain of rocky islets lying south-east of it is $2\frac{1}{2}$ miles eastward from Kahandawa point, the coast between being sandy and barren. Levay rock, very little under water, lies S.W. $\frac{1}{4}$ W., nearly one mile from Kalamatta point, and is at the edge of the shore reef.

Watta rock or islet, the outermost of the chain of islets off Kalamatta point, is $4\frac{1}{2}$ cables S.E. from that point. Rocks project $1\frac{1}{2}$ cables south-east from Watta rock.

Kalamatta rocks, nearly awash, form a rocky patch three-eighths of a mile northward of Watta rock.

Anchorage.—Between Kalamatta rocks and the chain of islets of which Watta rock is the southern, there is anchorage in from 5 to 7 fathoms, sand; and between Kalamatta rocks and the shore to the northward, anchorage in 4 to 6 fathoms, sand and ooze, off the small village of Kalamatta; the ground to the eastward of Kalamatta rocks is foul. The only landing place is close to the northward of Kalamatta point.

Ulandhe point, the east point of Kalamatta bay, is high, sandy, and barren.

Rattan or Rattana point, $3\frac{1}{4}$ miles eastward of Kalamatta point, consists of red cliffs of moderate height. Some rocks above water lie close off Rattan and Ulandhe points, inside the reef, which here projects half a mile from the shore.

Godaway point, 4 miles eastward of Rattana point, is high, rocky, and barren. The coast between Godaway and Rattana points is low, sterile and lined with reef, except about midway between the two points, where the mouth of the river Waluwi is situated, and there are a few clumps of cocoa-nut trees.

Ibha rock is dangerous, and has less than 6 feet of water over it; it lies from Godaway point S.S.E. $\frac{7}{8}$ E. three-quarters of a mile, and there are 6 to 9 fathoms between the rock and the shore.

Nehindi rock, awash, is one mile eastward of Idha rock, and has 9 to 10 fathoms all round. From it Hambantotti tower bears N.E. by E. $\frac{1}{4}$ E., $3\frac{1}{4}$ miles. The depth between Nehindi and Idha rock is 9 to 10 fathoms, and generally 7 fathoms between Nehindi and the coast.

Caution.—From the form of the land no good marks can be given to clear the Ibha and Nehindi rocks, which do not always break; to avoid them a vessel should not come into less than 20 fathoms when approaching this part of the coast, which depth will be found about 2 miles outside, or southward of them.

HAMBANTOTTI POINT, 5 miles eastward from Godaway point, is high, sandy, and barren; on its summit stands a round tower and several houses. To the north-east of Hambantotti point is Hambantotti bay with anchorage in it from 4 to 7 fathoms, sand and ooze. The town of Hambantotti is northward of Hambantotti point. There is an assistant government agent here, and special port rules for the anchorage

Anchorage.—In the north-east monsoon vessels calling here should anchor to the eastward of Hambantotti point in 8 to 9 fathoms, sand ; but in the south-west monsoon they should proceed further under the lee of the point into the bay, so as to avoid the swell. A good position is with the tower bearing S.W. by W. $\frac{1}{4}$ W., and the eastern extreme of Hambantotti point, S.S.W. $\frac{1}{4}$ W. in 5 to 6 fathoms. All dangers in Hambantotti bay are above water and visible. The government coasting steamer calls here twice a month.

Winds.—From observations taken in the year 1890, south-west and westerly winds prevail at Hambantotti from April to October ; and north-west winds are common in August. Calms are frequent in November. North-east winds blow in December and January ; in February the south-west winds exceed the north-east, and in March south-east winds prevail more than those from any other direction.

Levay point, forming the N.E. point of Hambantotti bay, is $1\frac{1}{8}$ miles north-eastward of Hambantotti point.

Patteraja point, of moderate height, sandy and barren, is $6\frac{1}{2}$ miles eastward of Hambantotti point, the coast between being of the same sandy barren nature and lined with a reef.

DORÁVA (MAGO) POINT, E.N.E. 12 miles from Hambantotti point, is flat, rocky, and of moderate height, the coast between continuing its sandy barren nature. About 2 miles to the westward is a small river near the village of Mahagam, the mouth of which is closed by a rocky bar.

Lansiya rock, small and above water, lies S. by W. about $4\frac{1}{2}$ cables from Doráva point ; rocky patches extending between the rock and the shore.

Doráva rock, having over it 3 fathoms of water with from 9 to 11 fathoms all round, bears from Doráva point S.E. $6\frac{1}{4}$ cables, and nearly the same distance E. $\frac{1}{2}$ S. from Lansiya rock. Kataragam (Kattregammi) peak, (1,395 feet high, and 10 miles northward of Kirindi point), in line with the eastern extreme of Kirindi point about N. $\frac{1}{4}$ W., leads a quarter of a mile eastward of Doráva rock ; and Mahagam point well open southward of Lansiya rock, about W. by N., leads southward.

A bank, with a depth of 14 fathoms on it, and 30 to 32 fathoms around, is situated S.S.E. $\frac{3}{4}$ E. $6\frac{3}{4}$ miles from Doráva point. This is probably the position in which breakers were said to exist by Horsburgh. Breakers have recently been seen near this position, but

no rock was found on an examination of the locality by the I.G.S.S. *Investigator* in 1889. The whole of the vicinity, 4 to 8 miles south-westward of Great Basses lighthouse is covered with swirls and eddies, and the sea may break there in many places.

KIRINDI POINT, rocky, rugged, of moderate height, having several large rocks on its summit, near which a temporary flagstaff is sometimes erected, is $1\frac{1}{4}$ miles north-eastward of Doráva point. Korha rock, above water, lies E.S.E. 3 cables from the point; with Kirindi rock, on which there are 8 feet water, 2 cables to the northward. A reef of some extent lies N.N.E., 4 cables from Korha rock. To the northward of Kirindi point is a small bay, in which small craft anchor in from 3 to $3\frac{1}{2}$ fathoms, off the salt stores on the beach, but this anchorage is difficult of access.

Tides.—It is high water full and change in Kirindi bay at about 3h. 30m.; springs rise 2 feet.

Anchorage.*—The outer anchorage is in 9 to 10 fathoms, with Korha rock, N.N.W., about half a mile. North-eastward of this position the ground is foul.

Paltopani point, or Pultopani, is low and sandy, and is $2\frac{1}{2}$ miles north-eastward of Kirindi point, the coast between being barren, sandy, and fringed with reef. About half a mile N.N.E. of Paltopani point the coast forms a bight, and on the summit of the rising ground near the beach stands Paltopani fort.

Levay point, $1\frac{3}{4}$ miles north-eastward of Paltopani point, has foul ground extending from it for a third of a mile to the south-east.

GREAT BASSES is a dangerous reef of red sand-stone rocks, 6 miles south-eastward from Levay point, three quarters of a mile long, in a N.E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W. direction, by a quarter of a mile broad, and about 8 feet above the surface of the ocean.† The reef is continuous, portions only showing here and there in the wash of the sea; the north-eastern part is the highest and broadest, forming a rocky wedge-shaped ledge 70 yards long, N.E. and S.W., by about 30 yards broad, and from 6 to 8 feet above high water.

Great Basses reef has deep water to within half a mile of it on all sides; but on the western side, about one mile from the reef, there is a patch of 8 fathoms; and on the eastern side at $1\frac{1}{8}$ miles, is another of 5 fathoms, with deeper water between it and the reef.

* See plan of Kirindi road, scale $m = 3$ inches, on Admiralty chart, No. 813.

† The description of Great Basses reefs, &c., is compiled from the remarks of Captain W. J. S. Pullen, H.M.S. *Cyclops*, 1860.

LIGHT.—On the north-east or highest part of Great Basses reef, is a granite light-tower, 127 feet in height, from which is exhibited at an elevation of 110 feet above the sea, a *revolving red* light, which attains its greatest brilliancy *every forty-five* seconds, and in clear weather should be seen from a distance of 16 miles.

Kataragam peak bears N.W. $\frac{3}{4}$ N. from Great Basses lighthouse.

The roof of the lantern is conical, a gallery surrounds the tower at a distance of 30 feet from the base, and a second gallery immediately under the lantern, which peculiarities serve to distinguish it from the Little Basses light-tower, which has a domed roof and two galleries 12 feet apart near the lantern.

Fog signal.—In thick or foggy weather a bell is sounded *once* every *fifteen seconds*.

LITTLE BASSES.—The light-tower built on this reef bears N.E. $\frac{1}{4}$ E., distant 20 miles from the light-tower on the Great Basses. The reef is only about 2 feet above water, and appears to consist of large boulders, which even by daylight are scarcely perceptible till close up to them. The extent of that portion usually shown by breakers is not more than a quarter of a mile across, about E. by S. $\frac{1}{2}$ S. and W. by N. $\frac{1}{2}$ N.; but W.S.W. from its western part are many sunken patches, breaking so much in heavy weather, that occasionally the sea is covered with surf for a distance of $1\frac{1}{2}$ miles.

The Little Basses is not more than $4\frac{1}{2}$ miles from the nearest part of Ceylon; and on its northern side are several patches of shoal water, one of which, carrying the least water, 3 fathoms, bears N. by W. $\frac{1}{2}$ W., distant $1\frac{1}{2}$ miles from the Little Basses light-tower. This patch is of limited extent, having $3\frac{1}{2}$ and 4 fathoms water close to on its southern and western sides, and 6 and 7 to the northward and eastward. It is concluded to be the shoal on which the *Atlas* (one of the fleet under convoy of H.M.S. *Dædalus*) first grazed over on the morning of the 2nd July 1813.

Atlas reef, bearing N.E. $\frac{3}{4}$ N. $1\frac{1}{2}$ miles nearly from Little Basses, is another patch of 3 fathoms, with 4 and 5 fathoms water close around it, is probably the reef over which the *Atlas* grazed the second time.

The Little Basses should always be approached with caution, and a vessel should never attempt to pass between it and the Ceylon shore.

LIGHT.—On the centre of Little Basses reef is a granite light-tower, from which is exhibited at an elevation of 110 feet above the sea, a *flashing white* light, which shows *two flashes every minute* in

the following manner :—A flash of *seven seconds* duration, an eclipse of *eight seconds*, then a flash of *seven seconds* duration, followed by an eclipse of *thirty-eight seconds*. It should be visible in clear weather from a distance of 16 miles.

The lantern has a domed roof, and two galleries, 12 feet apart, surround the light-tower near the top, from which it may be distinguished from the Great Basses light-tower, which has a conical roof and one gallery near the lantern, and another, 30 feet from the base of the tower.

Fog signal.—In thick or foggy weather a bell is sounded *twice* in quick succession *every half minute*.

THE SOUTH-EAST COAST of Ceylon between Doráva and Julius Nave points, a space of 30 miles, trends nearly N.E. and S.W., with ranges of high mountains inland, often obscured, however, by the hazy state of the atmosphere, said to be peculiar to this part of the island, particularly during the south-west monsoon. Near the coast inside the line of the Basses, are several remarkable hills which form admirable landmarks, during daylight and fine weather, for navigating in the vicinity of the Basses.

The shore is comparatively low and barren, fringed with a belt of sand, but without any marked features; the points are generally rounded and sandy, rising to elevations of about 100 feet. Off the pitch of all the points are rocky patches, extending in some cases to the distance of a quarter of a mile. Along the whole line of coast the surf breaks heavily on the beach, the first roller rising at the average distance of a cable's length from the shore.

Kataragam peak (Kattregammi hill).—The most prominent land seen when approaching the Basses from the westward is the Kataragam range of hills, the highest of which is between 7 and 8 miles distant from the sea. These hills are sometimes conspicuous both from the eastward and westward, when others nearer to the sea are hardly discernible. Their summit presents an irregular ridge, the north-east peak of which (1,395 feet) is the highest.

Elephant hill, or rock, the next height to the eastward, is conspicuous from its standing alone on the low land near the shore, and bearing a remarkable resemblance to the animal from which it is named. It is 2 miles from the beach, bare and destitute of trees on its summit, which is 480 feet above the sea.

Little Elephant hill, in shape resembling a haycock, stands on the extreme point forming the western horn of Elephant bay; its

elevation is 105 feet, and from it Elephant hill bears N.W. 2 miles. Off this point, at the distance of one third of a mile in an E.S.E. direction, is a rock just above water.

Anadowi point, next west of Little Elephant, may be known by its off-lying rocks. The outer one, which is about 4 feet above the sea level, is distant three-eighths of a mile from the shore, and is steep-to on the outside, having 7 fathoms within a cable's length.

Dematagala (Nipple hill) bears from Elephant hill N. by E. $\frac{3}{4}$ E. distant about 9 miles. Rendered conspicuous by its superior elevation, 903 feet above the sea, this peak is also distinguished by a flattened summit, and when seen on a north-west bearing, two lumps, one at each end, are visible; the western of these nipples is the higher. When seen on southerly bearings, there is nothing remarkable in the appearance of this hill, except that it is higher than those near it. This hill may also be known by a remarkable cone W.S.W. of it, generally distinguishable, but more so from the eastward, although only 520 feet above the sea.

Mandagala, next in succession eastward, is of use for ascertaining a vessel's position. It is 5 miles from the nearest beach, 513 feet above the sea, and conspicuous, its summit having a precipice of light-coloured rock facing northward. When this hill bears north-westward the top of the precipice appears clear of the summit of the hill. From the Great Basses it is not easily seen, being sometimes concealed by the haze which generally hangs over the land, especially in the south-west monsoon.

Chimney hill (Pagoda peak), about 11 miles north-westward of Mandagala, is a remarkable hill, its base appearing as a truncated cone surmounted by a perpendicular rock, much like a chimney, hence its name. Isolated and conspicuous, this hill may be kept in sight by a vessel passing at a distance of about 4 miles from the coast, the hill showing up above the low intervening land.

Potana point, a sand hill 105 feet high, is rather more than one-third the distance along the coast, between Elephant and Mandagala hills. Potana point forms the deepest bay on this part of coast, but a heavy sea setting into it, throws the surf up to its innermost south-west angle. Off Potana point, and also westward of it, the shore is beset with detached rocks for about a mile out, on which the sea is always breaking, thus presenting the characteristic feature of the coast, viz., a rocky sandy shore, wherever there is any tendency to a point.

Off Potana point is the only anchorage inshore, that was used or found available for H.M.S. *Cyclops* in the course of the survey. She anchored in from 5 to 6 fathoms water, with the point bearing about W.S.W.

DANGERS WITHIN the BASSES.—Elephant reef is $1\frac{1}{2}$ miles in length, N.E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W., and a quarter of a mile broad. The north-east breaker on it is $1\frac{3}{4}$ miles from Little Elephant hill, which is in line with Elephant hill. Between this reef and the land is a clear channel, carrying 8 to 9 fathoms.

Potana reef, the centre of which lies E. by S. $\frac{1}{2}$ S. $2\frac{1}{4}$ miles from Little Elephant hill, is a rocky patch about half a mile broad and nearly square, on which the sea always breaks. No broken water was seen between it and Elephant reef; there may be deep water between them, but the space has not been examined, and should not be attempted.

Cyclops reef is a narrow, sandy ridge, with patches of rock and boulders, having only 2 fathoms on it in some places. It is $3\frac{3}{4}$ miles long, E. by N. $\frac{1}{2}$ N., and W. by S. $\frac{1}{2}$ S., and from a quarter to half a mile in breadth. From its west end, in 3 fathoms, Potana point bears North 2 miles; and from its eastern end, in 4 fathoms, the same point is W. by N. $\frac{1}{2}$ N. $3\frac{1}{2}$ miles. This reef is dangerous in consequence of the sea breaking only occasionally on it, and from its having deep water close to on each side. The channel between the western extreme of Cyclops reef and Potana reef, 2 miles wide, with from 8 to 10 fathoms, was frequently used by the *Cyclops* in passing between her anchorage at Potana and Great Basses. Mandagala, on with Potana point, leads through in mid channel.

Dædalus reef is a small narrow patch of 15 feet, lying N.N.W. $3\frac{1}{2}$ miles from Little Basses, and $1\frac{1}{2}$ miles off shore, with Mandagala bearing N.W. by W. The *Cyclops* struck heavily on this shoal, but from its being so narrow, was soon off, and could not again find the exact place with the lead. The depth was, therefore, determined by the ship's draught of water. From Horsburgh's description this is the shoal on which the *Dædalus* was wrecked, for it states "she fell over and went down," the only spot where this could happen from the deep water close around it. The *Cyclops* had 7 fathoms as soon as she was off.

Inside passage.—There is a deep channel within the before-mentioned dangers that may be taken, but only in case of necessity, by keeping about midway between the Elephant, Potana, and Cyclops shoals on one hand, and the mainland on the other, or a mile off

shore. The Dædalus reef may be passed on either side. If passing inside from the westward, keep about a mile from the shore till abreast Julius Nave point, then edge farther from it; if passing outside, keep about half way between the Little Basses and the shore; but no stranger should attempt the inner passage unless in case of sheer necessity, as the coast does not permit of any leading or back mark being given.

A vessel bound westward, after clearing the Little Basses, and certain of daylight, if keeping a good look-out, may pass inside the Great Basses; she may also do the same going to the north-eastward, but when clear of the Great Basses she must haul well to the eastward to pass outside the Little Basses, the light-tower marking which will be a good guide.

The coast is clear as far as Galle and may be approached to 2 miles distance, but only in daylight, as it is impossible to judge of distances accurately by night.*

CURRENTS in the vicinity of the Great and Little Basses reefs are remarkable for their rapidity and eccentricity. In a line between the two reefs, that is, about 6 miles off shore, the current, during the south-west monsoon, sets along the coast, to the north-east, at the rate of one to 2 miles per hour, only diverging from this course when within the influence of the broken ground of the reefs. The rate, influenced by the strength of the wind, is most irregular; the best way, therefore, of avoiding danger is to give the rocks a wide berth, although it may incur a loss of time.

Between Point de Galle and the Basses the current sets along the line of coast, the rates varying at different times without any apparent cause from one to 4 knots; but to the northward of the Little Basses, close in on the eastern shore, a decided southerly set was experienced during the south-west monsoon by the *Cyclops*, at the rate of nearly a mile an hour, which increased to 2 knots near Trincomali. While lying within Little Basses, this southerly set to windward was occasionally felt, the wind blowing strong enough at the time to keep the ship broadside on; but this seldom lasted more than a couple of hours. At Great Basses it was never felt, and only occasionally as far west as the anchorage off Potana point; the greatest strength found at Little Basses was three-quarters of a knot.† The strongest wind and worst sea during the north-east monsoon are to be met with off the Basses, but less close to them than in the offing, and

* Commander C. Murray Aynsley, H.M.S. *Assurance*, remarks, 1861, that during the north-east monsoon a vessel can anchor anywhere along the south coast of Ceylon, and that the currents are of greater strength in the offing than close in shore.

† H.M.S. *Cyclops*, 1860.

a few miles to the northward of the Little Basses the weather becomes finer.*

Between Dondra head and Tangalle there is often a strong indraft when the current is setting strong to the westward.

The following table showing the winds and currents at Little Basses rocks has been compiled from a memorandum (April 1869) by Mr. John Buchanan, master of the light-vessel, which marked the position previous to the erection of the light-tower.

Month.	Wind and Weather.	Current.		REMARKS.
		Directions.	Rate per hour, knots.	
January -	Strong, steady N.E. monsoon.	S.S.W. -	2 to 3½ -	Sea cross and rough. Steam vessels steering N.N.E. have remained in sight for 2 hours. Ships bound to N.E. should avoid S.E. coast of Ceylon this month.
February-	N.E. monsoon, lighter towards end of month.	S.S.W., but sometimes slackens.	2 - -	At the end of February land and sea breezes commence, and there are regular tides at springs.
March -	Land and sea breezes prevail.	Generally S.S.W., but variable at times.	Weak -	Passage up and down coast easy this month, which is fine. Temperature 87° in the shade.
April -	Sometimes N.E. sometimes S.W.	Very little, but occasionally strong to S.W.	Weak. If to S.W. strong.	Gloomy weather; occasional showers, thunder and lightning. Intense blackness over the land.
May-	S.W. monsoon sets in between 1st and 20th.	N.E. - -	1 to 3 -	Much rain, thunder, and lightning. After S.W. monsoon sets in no rain until October.
June -	S.W. monsoon begins at 10 a.m., increases to a gale by noon, so continues until 4 p.m. and decreases towards sunset. If it continues after sunset, moderates at 10 p.m.; strong breeze only at night.	N.N.E.† -	1 to 3 -	As sun passes southward of the equator, regular S.W. monsoon ceases on south coast of Ceylon, wind becomes variable, land and sea breezes setting in, with intervening calm.
July -				
August -				
September				
October -	Regular land and sea breezes.	Towards the end of the month S.S.W.	5 - -	Direction of current changes about middle of month, and runs to south-west until middle of March.
November	Land and sea breezes in early part; N.E. monsoon sets in strong towards end of month.	S.S.W. -	4-5½ - -	Rainy, with thunder and lightning.
December	N.E. - - - -	S.S.W. -	5 - -	Current setting to the southward attains its greatest strength. In December most difficult to proceed to the northward along the south-east coast of Ceylon.

* Commander C. Murray Aynsley, H.M.S. *Assurance*, 1861.

† A remarkable circumstance occurs with regard to current during the south-west monsoon. After running 3 knots to the N.E. for ten days, suddenly it slackens, and runs from 2 to 3½ knots S.W. or out of the bay of Bengal, lasting sometimes one day, at others a week; these changes happen at all phases of the moon, and appear to obey no recognised law. (From Report of Mr. Buchanan, master of the former Little Basses light-vessel, April 1869.)

‡ In November 1879 H.M.S. *Orontes* experienced a southerly current of nearly 5 miles an hour, when steaming between Little Basses and Batticaloa.

The period during which ships can most easily proceed north, is that between February 15th and October 15th; in November, December, and January it will be found difficult, except in full-powered steam vessels. The currents, from the middle of November, or during the north-east monsoon, set south-south-west out of the bay of Bengal for about 5 months; thus a steamer, steering N.N.E., has not only to oppose a 3-knot current, but also has the wind against her. During the remaining seven months the currents are nearly equally divided; about twice a month in the south-west monsoon the current will suddenly change from north-north-east to south-south-west.

During the south-west monsoon, in the event of a sailing vessel making Dondra head, when bound to Galle, which is not uncommon. the master should never attempt to beat to Galle, but recross the equator.

DIRECTIONS.—From the westward.—In the south-west monsoon with the current running to the eastward a ship passing Dondra head will probably be sooner abreast of Great Basses rocks than expected, although the easterly current is not constant, and occasionally during the south-west monsoon sets to the southward and almost always so during the north-east monsoon. Pass Dondra head at a distance of about 9 miles, steering E. by N. or E. by N. $\frac{1}{2}$ N. according to the distance from the land, taking care to sound in time if it be night. Having run in the night about 25 miles to the eastward of Dondra head, a ship should not come into less than 36 fathoms. To the westward of Dondra head, 25 fathoms will carry clear of all dangers by day, and 20 fathoms to the eastward of Dondra head; but to pass outside the Basses rocks at night, a sailing ship should haul out when approaching them into 40 fathoms. The passage inside the Basses must be considered hazardous with our present knowledge of this coast.

From the northward, and bound west round the Basses in a sailing vessel with the wind fair, keep on the edge of the bank of soundings when approaching the Little Basses, and at night do not come into less than 70 fathoms of water, which will keep a vessel from 2 to 4 miles outside the Little Basses and 7 miles outside the Great Basses, the lights in both cases being clearly distinguishable, that on the Little Basses white and flashing, that on the Great Basses red and revolving. The uncertainty of the currents must also be considered, particularly near both the Great and Little Basses, where they sometimes set towards the shore (*see* page 76).

THE SOUTH-EAST COAST* of Ceylon trends north-eastward from Potana point for about 10 miles to Mahagagabawa (Julius Nave) point, which latter being low and sandy, is not easily distinguished from seaward. Northward of this the coast offers but few conspicuous objects; its general character is low and monotonous; from Kumbukkan Aru, on the northern side of Julius Nave point, to Komarie, jungle is prevalent; thence to Vendelus bay, cocoa-nut trees abound; while beyond the latter to Foul point nothing but jungle is again to be seen.

The coast between Kumbukkan Aru and Komarie, 30 miles distant, trends in a general N. by E. $\frac{1}{2}$ E. direction, and is broken only by a few slight indentations. The shore line is nearly all sand backed by jungle, which extends over low flat wooded ground, joined by isolated hills, which are at a considerable distance from the sea, of which Dematagala, Mandagala, and Chimney hill (*see* page 73) are of much use in determining a vessel's position.

CURRENTS.—Between Basses rocks and Trincomalí. —Observations were made every hour, whenever the *Egeria* was anchored, during the course of the survey (March to August) between these points, to ascertain the direction and velocity of the inshore currents; but no rules could be deduced from the facts obtained. The direction often changed from North to South, and back again, without any apparent reason. On no occasion, however, were the inshore currents found to set in any direction other than parallel to the shore. In standing offshore the northerly and southerly currents were found running side by side, the vessel passing from one to the other more than once between 3 and 10 miles from the coast.

Near Trincomalí, between the end of October and end of December, a southerly set of 2 to $3\frac{1}{2}$ knots an hour may be expected. From the end of December to March, a weak northerly set less than one knot an hour. Between March and September a variable moderate current; and in September and October, an irregular current, sometimes running strongly to the northward, and sometimes to the southward.

CAUTION.—From the above it will be seen that great care is necessary in navigating near this part of the coast of Ceylon; but as the soundings have been fully and accurately taken in the locality,

* The description of the coast between Little Basses and Foul point, Trincomalí, is from a survey by Captain Aldrich, H.M. Surveying vessel *Egeria*, March to August 1887.

the use of the lead should warn the seamen of any approach to danger, and enable him to ascertain his position.

Yakala is a small village situated a short distance from the sea, and not visible from the offing. The locality of the village may be known by a little grassy hillock or mound, which stands on the beach about $2\frac{1}{2}$ miles north of Kambukkan Aru river.

At 5 miles northward of Yakala commences a rugged rise, 372 feet high, named Rugged ridge, and easily distinguished. Thence to Panawa point, 8 miles northward, the only remarkable object is a solitary sand hill $3\frac{1}{2}$ miles southward of that point.

Between Yakala and Rugged ridge the coast is foul to a distance of three-quarters of a mile.

Panawa point, a sandy ridge covered with jungle, terminates in a scrub-covered rocky point 85 feet high, which when seen from the northward and southward makes as a flat-topped islet. Southward of the point there is a great deal of bare sand. Bolt islet, nearly 3 miles northward of Panawa point, is a rounded and scrub-covered rock 92 feet high.

Arugam bay, 5 miles northward of Panawa point, has good landing in its south corner. During the period between February and May coasting vessels arrive for the purpose of shipping timber. The entrance of the river is in this bay, but during the time the survey was in progress it was found to be completely barred by sand.

Nilagalahela, or Saddlehill, 655 feet high, stands by itself 8 miles westward of Arugam bay, and has two summits, the north-eastern one being a little higher than the other. Nilagalahela, when seen on a westerly bearing, appears as a single-peak hill, steep on the southern side. Darker in colour than the surrounding country, and being the highest hill within a radius of some miles, it is useful as a landmark.

Sangama Kanda is 12 miles northward of Arugam bay, 283 feet high, and 3 miles inland. About Sangama Kanda the land becomes higher, and consists of scrub-covered hills between 200 and 280 feet high, with no well-defined summits. Close southward of Sangama Kanda there is a long sand patch on the coast line. This, with the higher land alluded to, marks the locality of Komarie and of Komarie ridge. From hereabouts the peak of Wadinagala or False Hood, Kumburahela, and Westminster Abbey, are very conspicuous. Friar's hood, to the northward, shows up well, while the Pambuthai range extends a good part of the way between the Hood and the hills about Wadinagala.

Komarie (Sangama Kanda) point is a wooded curve a short distance north-eastward of Komarie village, and is not easily distinguished from the offing, while the village cannot be seen at all.

Soundings.—The soundings off this portion of the coast are for the most part regular, and increase gradually as the shore is left, the chief exception being the ground between Arugam bay and Sangama Kanda, and the shoals now to be mentioned.

Komarie ridge.—This dangerous shoal, composed of sand and coral, and having $2\frac{3}{4}$ fathoms least water, is about $3\frac{1}{2}$ miles long, and extends nearly parallel with the coast. The south extreme of the shoal is in lat. $6^{\circ} 59' N.$, and 8 cables from the shore; the north extreme in lat. $7^{\circ} 2\frac{1}{2}' N.$ is nearly $1\frac{1}{2}$ miles from the shore.*

Egeria patch.—Seaward of Komarie ridge, to a distance of 4 miles from the shore, the bottom is uneven. Egeria patch, with a depth of 7 fathoms, lies nearly 4 miles from the coast with Kumburahela bearing $N. 71^{\circ} W.$

From the very uneven nature of the bottom, breakers may be caused by winds and currents. The currents run with considerable strength and are irregular, but they were found to set along the shore northward or southward, and not towards the shore.†

The COAST from Komarie has a general northerly direction as far as Batticaloa. The land near the sea is low and flat, and in many places cultivated with cocoanut. At 20 to 30 miles inland are several conspicuous hills. Kumburahela (Aganis peak) is 1,134 feet high, sugar-loaf in form, and stands by itself nearly 13 miles westward of Sangama Kanda point.

Westminster Abbey, 7 miles westward of Kumburahela, is a remarkable hill. The so-called tower is at the north-west end, 1,830 feet above the sea. The hill is seen to the greatest advantage from a position northward of Komarie, though it is readily distinguished from the southward also.

Wadinagala (or False Hood), 4 miles N.N.W. from Westminster Abbey, is conspicuous on all bearings. The summit is precipitous or nearly so all round, and forms a sharp peak 2,413 feet high. In clear weather the higher and more distant hills are visible. Of these are Maragalkanda, a long rounded hill, and Namanukuli; the latter, 6,680 feet high, rises to a sharp peak, and somewhat resembles

* The rock on which the s.s. *Macgregor* struck in 1881, reported to lie S. by E. $\frac{1}{2}$ E., $3\frac{1}{2}$ miles from Sangama Kanda point; also a shoal of 6 feet water, previously reported as lying nearly 2 miles E.S.E. from that point; are probably parts of Komarie ridge.

† Granville (Graville) rock, said to be situated with Komarie point bearing N. by W. $\frac{3}{4}$ W. distant 6 miles, was not found during the survey of 1887.

Wadinagala. Of the lower hills, Sharp hill, 6 miles from the coast, Thomson hill, wooded, and Bennington hill, wooded and wedge-shaped, are noticeable.

Friar's Hood, 21 miles northward of Westminster Abbey, and 2,140 feet high, is well named, and readily distinguished in clear weather at long distances. There are other hills round it, but the peak of the Hood is unmistakable.*

Soundings.—The soundings between Komarie and Batticaloa are regular, with the exception of a few rocky patches within a mile of the shore. Beyond this distance, the lead is of great use.

Alphee shoal, having a depth of $3\frac{1}{4}$ fathoms, coral, is about $1\frac{1}{4}$ miles from the nearest shore. Its extent within a depth of 5 fathoms is about $1\frac{1}{2}$ miles north and south and three-quarters of a mile east and west. The shoal head lies with Friar's Hood W. $\frac{1}{8}$ N., and Wadinagala S.W.

BATTICALOA, the principal town in the eastern province of Ceylon, is situated 3 miles from the northern entrance of Batticaloa lagoon. The bar, which has a depth of 6 feet at low water, extends across the entrance. During the south-west monsoon—March to September—there is not much difficulty in crossing the bar. But the north-east monsoon sends in a heavy sea, and gales from the north-east are not unfrequent; the channel shifts after each gale, so that communication between land and sea is seldom possible between October and March.†

LIGHT.—From the signal staff is exhibited, at an elevation of 47 feet above the sea, a *fixed white* light, visible in clear weather from a distance of 8 miles.

Pilots.—The natives at the signal station are all acquainted with the bar, and the usual pilot signal will bring them off. A small government coasting steamer calls here fortnightly, but seldom communicates during the north-east monsoon.

Signal Station.—On the west side of the entrance is a signal station with flagstaff, also the Custom-house and a few other houses. The flagstaff is 47 feet high and a good mark for recognising the locality, as it is visible a considerable distance. Vessels may communicate by the International code of signals.

Obelisk.—About a cable from the beach, at three-quarters of a mile to the north-westward of the signal station, is a white obelisk

* See Admiralty chart, Ceylon east coast, No. 2,031.

† See Admiralty plan of Batticaloa roads on Admiralty chart, No. 2,031; scale $m = 4$ inches.

25 feet high, conspicuous in the forenoon and nearly always seen quite distinctly before a vessel reaches dangerous ground.

Communication.—The signal station has telephonic communication with the town, thence by telegraph with Colombo. There is a good road between the bar and the town, and communication also by boat. A government agent resides at Batticaloa.

Caution.—In attempting to sight Batticaloa light at night, the lead should be constantly attended to, and the water should not be shoaled to less than 10 fathoms until the light is sighted.

Anchorage.—The roadstead affords good anchorage in the south-west monsoon. Foul ground extends some distance north-eastward of the signal staff, and in approaching from the southward the soundings should not be shoaled to less than 10 fathoms until the obelisk bears S.W.

Beacon rock, on which there is a black buoy during the south-west monsoon, has $1\frac{1}{2}$ fathoms water and lies N.E. by E. $\frac{1}{4}$ E. $1\frac{1}{2}$ miles from the flagstaff.

Brennus shoal, having a depth of $1\frac{3}{4}$ fathoms, lies N.E. $\frac{1}{2}$ E. a mile from the signal staff. There is foul ground within a distance of 2 cables east and west of this position, and all the ground between Brennus shoal and the shore is foul.

A coral head with 3 fathoms lies N.E. by N. $1\frac{1}{4}$ miles (nearly) from the signal staff and N.E. by E. $\frac{1}{8}$ E. $1\frac{1}{2}$ miles from the obelisk. The shoal is not marked.

Surveyor rock consists of two patches with $3\frac{1}{2}$ fathoms on them. The north-eastern patch lies N.E. $\frac{3}{4}$ N. 8 cables from the obelisk and N. $\frac{3}{4}$ W. 9 cables from the flagstaff, and is marked by a red buoy during the south-west monsoon.

The south-western patch (named Khandalla) lies N.E. $\frac{3}{4}$ N. 7 cables from the obelisk.

DIRECTIONS.—A vessel may enter the roadstead with $4\frac{1}{2}$ fathoms least water by steering with the obelisk bearing S.W. until the signal staff bears S. by E., then anchor in $6\frac{1}{2}$ fathoms. This is a convenient berth for communication with the shore, and is more than one cable clear of Khandalla bank.

The best route in for a large ship is with the obelisk bearing S. by W., and the anchor should be let go in $7\frac{1}{2}$ fathoms when the signal staff bears S.S.E. $\frac{1}{2}$ E.

Local knowledge is essential in crossing the bar if there be any sea.

Winds.—From observations taken in the year 1890 it appears that easterly winds prevail more or less throughout the year at Batticaloa; being from between north and east from November until the middle of April; and between south and east from the middle of April until October. Westerly winds form about 20 per cent. of the whole, and may occur at any time, but are most common in July and August, and from north-west in January. Calms average about 3 days in each month.

THE COAST from the entrance to Batticaloa lagoon trends N.W. by N. 11 miles to Vendelus point, which is foul to a distance of a quarter of a mile. Nearly midway is Puna Kuda point, on the north side of which is the bight named Puna Kuda.

Kal Kuda (Rocky bay), on the south side of Vendelus point, is so called from a number of sunken rocks. It is considered possible that good shelter may be obtained here during the north-east monsoon for small vessels, in 2 to 3 fathoms close in shore.

Beacons.—A dome-shaped beacon, surmounted by a ball, the whole painted white, has been erected on the extreme of Vendelus point. Two beacons, each 40 feet high, and surmounted by a tripod, have been erected on the land about a mile southward of Vendelus point. The front beacon is painted white, the rear beacon red; these in line bearing W. by N. lead clear of the rock, with 8 feet water on it, situated one mile southward of Vendelus point.

Anchorage.—Two beacons, similar in every respect to the above leading beacons, have been erected in the north-west part of Kal Kuda, a quarter of a mile eastward of the Rest-house. These in one lead to the anchorage, where a red buoy is moored half a mile from the shore.

Vendelus bay.—Northward of Vendelus point is Vendelus bay, or as it is named by the natives Passi Kuda (Mosay bay). The Valaichehenai river falls into this bay; shoal and foul ground extends a mile seaward of its mouth, and skirts also the shores of the bay.

Clarke point, nearly 5 miles to the northward of Vendelus point, is low and surrounded by rocks and foul ground. Off the north extreme is Elephant rock, 60 feet high, light in colour, and visible from a distance of 12 miles. ✓

Soundings.—Between Batticaloa and Clarke point the soundings are regular beyond the 10-fathoms line, but at night, or in thick weather, a vessel should not shoal to less than 20 fathoms: this depth will be found at a distance of not less than 2 miles from the several

points. But it should be observed that off Puna Kuda point there is a deep and narrow cleft in the bottom, where the 100-fathoms line of soundings is only 2 miles from the shore.

From Clarke point to Foul point the soundings outside the 10 fathoms line are regular, and the shore may be approached to that depth. On the edge of the bank of soundings the depths increase suddenly; heavy overfalls occasionally occur in the finest weather.

The offshore soundings now given are of such a nature as to render navigation safe even in thick weather, if the lead be attended to, and the ship not allowed to come into less than 20 fathoms of water.

The disasters which have taken place from time to time on this coast, supposed to have been on dangers situated some miles from the shore, were probably due to difficulties in fixing the true position; difficulties caused by the absence of soundings, and also by the fact that some of the mountain peaks in the interior, used as landmarks, were not in their true positions on the former charts.

THE COAST.—From Clarke point to Foul point lighthouse, a distance of 35 miles, the coast trends nearly N. by W. throughout; it is low, and the hills inland are few and unimportant. There are, however, several conspicuous rocks above water which lie at short distances from the land.

Cheltivo is a small wooded islet about 30 feet high, half a mile from the coast, and 9 miles northward of Elephant rock. Panditivo point is sharp, rocky, and has a small rock above water close to it. Virgil rocks, about 2 miles northward of Kadeawella point, are about a mile distant from the shore. They consist of two sunken rocks and one three feet above water. Tree rock, about 4 cables from the shore and 5 miles northward of Kadeawella, is so named from having a tree on it, and is thus easily distinguished.

Alligator rock, 3 feet high, is rather more than $1\frac{1}{2}$ miles from the shore, with a sunken rock close to its north-east side. This danger may be known by a conspicuous rock (Ship rock) 62 feet high, which lies nearly a mile inshore. There is also a conspicuous patch of rock on the coast line.

There are numerous detached rocky islets off Ilantattunu, one of which, 60 feet high, has trees on it and is therefore remarkable. So is White rock, 3 miles further north, during the forenoon: it stands on the beach and is 25 feet high. Heming rock is a group which extends to the north-eastward of White rock for $1\frac{1}{4}$ miles; the

Munayai Paru, a coral rock, on which a least depth of 18 feet was obtained (but there is probably less water), has recently been found in a position N.N.W. $\frac{3}{4}$ W. one mile from Foul point lighthouse.

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highest is 20 feet high : the north-eastern one, 7 feet high, is a mile from the shore.

Landmarks.—Tower hill has a conspicuous rock at the summit, which has the appearance of a tower ; the hill is otherwise hog-backed. Baron's cap, formerly known as Sugar-loaf, is 691 feet high, and S.W. by W. $\frac{3}{4}$ W., $12\frac{1}{4}$ miles from Vendelus point. From the eastward and southward it has the appearance of a sugar-loaf, and when seen clear of other hills is a conspicuous object, particularly so on a W. by N. bearing. Seen on a south-west bearing it has a much broader top, and in appearance merges into the hills to the southward.

Kirimechiodai Malai, westward of Clarke point, is 185 feet high, and only seen when bearing between W.N.W. and W.S.W., when it appears as a low wedge-shaped hill sloping from the northward up to a sharp little peak, which has a steep fall to the southward.

Kunchan Kallu, further westward, is 410 feet high, and when seen on a north-westerly bearing, wedge-shaped, with a moderately steep fall at the southern end. On a south-westerly bearing it appears as a low hill without any well-defined summit.

Small Quoin, 4 miles westward of Kunchan Kallu, is 518 feet high. When seen from the S.E. it slopes moderately on either side to a rounded and small summit.

Gunner's Quoin, a large wedge-shaped hill, much further inland, becomes very useful as a landmark and is well named.

TRINCOMALI BAY,* about 3 miles across at its entrance, and affording capacious and safe anchorage to all sizes of ships at all seasons, is divided into two parts,—Great bay, the shores of which are low, and which runs in about 6 miles to the south-west, and Trincomali harbour about 3 miles in depth, which, with its many armlets forms an irregular prolongation of Great bay to the north-west. The first Europeans who possessed this place were the Portuguese, who lost it to the Dutch, with whom it remained until 1782, when the British captured it, but in turn lost it to the French, who restored it to the Dutch. In 1795, it was again taken by the British after a three weeks' siege, and has since remained in their possession.

Foul point, low and covered with cocoa-nut trees, on the south side of the entrance to Trincomali bay, bears S.E. $\frac{1}{2}$ E., distant $5\frac{1}{2}$ miles from Flagstaff point on the north side of the entrance, and

* See Admiralty plan of Trincomali harbour and bays, No. 815, scale, $m = 1.7$ inches ; also No. 816 of Trincomali harbour, scale, $m = 6$ inches.

has a reef projecting from it to the northward for nearly a mile, with a depth of 9 feet of water over it.

LIGHT.—On Foul point stands a circular gray tower 120 feet in height, from which is exhibited, at an elevation of 104 feet above the sea, a *fixed and flashing white* light, showing a *flash* every *half minute*, which should be visible in clear weather from a distance of 17 miles; the faint light visible between the flashes is not seen more than 10 miles.

Norway point is $2\frac{3}{4}$ miles westward of Foul point, the coast between being low and forming a shallow bight. About half way between these points, and a mile off shore, is Northesk rock, having 9 feet on it. Several islets, and a rock awash, lie within half a mile of Norway point. Beacon rock lies S.W. by W. $\frac{3}{4}$ W. 6 cables from the point.

Norway sand stretches three-quarters of a mile off shore for $1\frac{1}{2}$ miles southward of Norway point.

GREAT BAY, probably more than 100 fathoms deep in its centre, sweeps round from Norway point in a semicircle to Marble point, which is hilly, and $3\frac{1}{2}$ miles westward of Norway point. The shores of the bay, out of which the Samboré, the Kottiá, the Mahavilla Ganga, and the Upá or Stately river, discharge themselves, are low. The Kottiá sand, having a depth of 3 to 4 fathoms on its outer edge, stretches 6 cables northward from the mouth of the Kottiá river. Nearly half a mile N.W. by W. of the entrance to the Samboré river is the Samboré shoal, having over it $2\frac{3}{4}$ fathoms, rock. Tamblegam shoal of 9 feet is distant $5\frac{1}{2}$ cables from the shore in the western part of the bay and bears S. by W. $\frac{3}{4}$ W., distant $1\frac{4}{10}$ miles from Marble point.

Marble point, the western extremity of Great bay, terminates a spur from the elevated land known as Diamond hill, and has off it depths of less than 3 fathoms, extending about 4 cables to the south-east.

Pigeon or Elizabeth island, lies S.E. distant one mile from Marble point; and the entrance to the extensive lake Tablegam, well marked by the islet of Noddi Tevú, is situated about a mile westward of Marble point.

Niger rock, on which Her Majesty's ship of that name struck in 1864, having over it 5 feet of water, bears S.E. by E. $\frac{1}{4}$ E., distant 4 cables from Marble point.

Round island, about a cable in extent north-east and south-west, and 50 feet in height, bears E. by N. $\frac{3}{4}$ N., distant 8 cables from Marble point, and has shoal water extending for about $1\frac{1}{2}$ cables from its south-west point.

LIGHT.—On the summit and near the centre of Round island, is a circular gray lighthouse, 69 feet in height, from which is exhibited, at an elevation of 103 feet above the sea, a *fixed white* light, which should be visible in clear weather from a distance of 10 miles.*

FLAGSTAFF POINT, on the north side of entrance to Trincomali bay is high, steep to seaward, covered with trees, and forms a tongue jutting to the northward from the peninsula that bounds the east side of Trincomali harbour. On the southern part of this tongue is fort Frederick, with a flagstaff standing in a prominent position, near its northern part, which is 170 feet in height.

Chapel point, the hill over which is 420 feet high, is the south-east extremity of the peninsula of which Flagstaff point is the northern limit, from which it is distant $2\frac{1}{2}$ miles to the southward; between, jut out Dutch and Rocky points, at distances of $1\frac{1}{10}$ and $1\frac{3}{10}$ miles respectively from Flagstaff point, on about a South bearing.

Chapel island, $1\frac{1}{4}$ cables to the south-east of Chapel point, has shoal water between it and the point, and dry rocks extending from it $1\frac{1}{2}$ cables to the south-west.

Chapel rock, above water, lies N.E. $\frac{3}{4}$ E. $4\frac{1}{2}$ cables from Chapel island. To the north-east of this rock at distances of one and 2 cables are depths of 2 and $2\frac{1}{2}$ fathoms.

Elephant point is the south-west termination of the high promontory forming the eastern side of Trincomali harbour, and bears about S.W. by W. $1\frac{1}{4}$ miles from Chapel point.

Elephant island, 4 cables south-east of Elephant point, is about 3 cables in extent north-east and south-west, and 30 feet high; foul ground exists between Elephant island and point, and also extends $1\frac{1}{4}$ cables westward of the west point of Elephant island, to Elephant rock, over which is a depth of 4 feet. A white buoy marks Elephant rock.

Clappenberg point, the eastern extreme of Clappenberg island, bears W. by S. $\frac{1}{2}$ S., distant 8 cables from Elephant point. A shoal having on it a depth of 4 fathoms, lies $1\frac{1}{2}$ cables N.E. $\frac{1}{2}$ E. from Clappenberg point.

* Reported by Nav.-Lieut. T. Robertson, H.M.S. *Undaunted*, to have been seen 16 miles, 1878.

Submarine Mine Field.—The area included in the triangle between Clappenberg point, the N.E. point of Small Sober island, and a red buoy moored $1\frac{1}{4}$ cables eastward of Small Sober island, is periodically obstructed by mines. The buoy has the words *Torpedo buoy* painted on it, and is surmounted by a red flag. Vessels should pass between this buoy and Ostenberg point.

TRINCOMALÍ HARBOUR.—Ostenberg point is $5\frac{1}{2}$ cables N.W. $\frac{1}{2}$ N. from Elephant point, the hill over it being precipitous and fortified. Nicholson cove runs in for 6 cables in a north-east direction, between Ostenberg and Elephant points, and has depths of from 8 to 15 fathoms. On the north side of Ostenberg point is the Naval Yard, about $3\frac{1}{2}$ cables northward of which, is the usual man-of-war anchorage. The northern and western parts of Trincomalí harbour are much indented by numerous bays or coves, which afford a large anchorage area, in depths varying from 7 to 15 fathoms. Vessels of any draught can enter the harbour at all times of tide.

Buoys.—In Trincomalí harbour besides the white buoy marking Elephant rock (already described) are the following :—

A white buoy marks Minden rock, which has a depth of 11 feet over it, and lies S.E. $\frac{1}{2}$ S. nearly 3 cables from Clappenberg point. The channel into Trincomalí harbour lies between the buoys marking Elephant and Minden rocks.

Two white buoys mark the north-western and south-eastern limits of a detached shoal, on which is a depth of as little as 3 feet, lying north-west of the Naval Yard flagstaff. A channel about half a cable in width, and carrying a depth of $4\frac{1}{2}$ fathoms, lies between the foreshore of the Naval Yard and the south-eastern white buoy.

A chequered black and white buoy, marks the western extremity of York shoal, on the north side of the man-of-war anchorage. The buoy lies in 23 feet of water, with Round island lighthouse just open of Ostenberg point, bearing S. $\frac{7}{8}$ E., and Admiral's flagstaff N.E. by E. $\frac{1}{2}$ E. Vessels must not attempt to pass between this buoy and York island, situated about 4 cables to the eastward of it.

A conical white buoy is moored in on the west side of Kerbela rock, over which there is a depth of 15 feet. This buoy bears N.N.E. $1\frac{1}{10}$ cables from the chequered black and white buoy marking the western extreme of York shoal.

GREAT SOBER ISLAND, the summit of which, Gravel hill, is 240 feet in height, lies three-quarters of a mile westward of Ostenberg point, and is separated from the western shores of Trincomalí

bay by French pass, 2 cables in width, and having 16 feet in the shoalest part of the channel, which is seldom used.

Small Sober island, eastward of Great Sober island, is 116 feet high. Shoal ground connects it with the south-east point of Great Sober island, and also extends about a third of a cable from its eastern shore, between which and Ostenberg point, is the channel into Trincomali harbour, about $2\frac{1}{2}$ cables in width.

From the Sober islands southward to Marble point, a distance of $1\frac{3}{4}$ miles, the western shore of Trincomali bay maintains its hilly nature, and is deeply indented with picturesque coves, or small bays, for which the chart is the best reference.

Grommet rock, detached, and 3 feet above water, lies $2\frac{1}{2}$ cables S.S.W. $\frac{1}{2}$ W. from Minden rock in the south-west part of the approach to the harbour.

DIRECTIONS from the southward.—Vessels should pass 2 miles eastward of Foul point, and then proceed N.W., steering for Round island when it bears W.S.W. Pass midway between Round and Elephant islands, and when Round island lighthouse bears S. by E. Ely., alter course to keep it on that bearing astern, to proceed up the channel to Ostenberg point.

From the northward Foul point lighthouse should be steered for when it bears South, and kept on that bearing until Round island lighthouse bears S.W. by W. when course may be altered for that island, afterwards proceeding as above.

Sailing Vessels will sometimes find it difficult to work into Trincomali bay against a westerly wind, as there is occasionally with that wind a strong outset from the southern part of the bay. Vessels in the south-west monsoon usually make the land southward of Trincomali. To avoid the outset, work up to the latitude of Flag-staff point, until close in with the land there, then stand to the southward (avoiding Chapel reef), until Round island just touches Marble point, which is a good tacking mark until well westward of Norway island. In approaching the southern part of Great bay the lead should be kept going, and the water should not be shoaled to less than 12 or 14 fathoms. A vessel may pass close to the east side of Round island, and from there the harbour's mouth will probably be reached without a tack.

Tides.—It is high water, full and change, at Trincomali at about 8h. 18m.; springs rise 2 and neaps $1\frac{1}{2}$ feet. There is sometimes a tidal stream of from one to $1\frac{1}{2}$ knots in or out of the harbour, and the under current differs occasionally from that of the surface.

Anchorage in Trincomalí harbour. That for vessels of war is northward of a line from S.E. head of Great Sober island to Ostenberg point; and southward of a line from Round point to south point of York island. The mercantile anchorage is nearer the town, to the northward of York island, in from 6 to 8 fathoms, with the landing wharf bearing N.E. $\frac{3}{4}$ E., and York island South.

Occasional Harbour Lights.—During the presence of a ship of war, a red light is shown from the Naval Yard on the north side of Ostenberg point, and when the colonial steam vessel is expected, a similar light is exhibited from the end of the pier, north-eastward of the merchant vessels' anchorage.

TRINCOMALÍ, which, with the exception of the official buildings, is poorly constructed, is built on the neck of the peninsula on the north-east side of the harbour.

The Admiral's house and grounds are situated on rising ground nearly a mile north-east of the Naval Yard; near at hand is a rest house for the use of the sailors of the fleet. On Sober island are three bungalows used by the officers of H.M. ships visiting the harbour. The surrounding country is sparsely inhabited, and provisions are brought in by water carriage. The population in 1890 numbered about 12,000.

Coal.—About 4,000 tons of Welsh coal are usually kept in stock. Colliers discharge over gangways, and lying 50 feet from the dock-yard wall, in a depth of about 21 feet. Vessels are generally coaled by lighters, each of about 50 tons capacity.

It is proposed to build a coaling wharf, 300 feet in length, with depths of 26 to 27 feet alongside.

Proposed Dock.—It is also proposed to build a graving dock at Trincomalí, to be 500 feet in length, with a depth of 30 feet on the sill at high water ordinary springs.

Repairs.—Small repairs can be executed at the Naval Yard. There are sheers of 12 tons lifting capacity, the depth alongside near them being 7 feet at low water.

Trade.—Shipping.—The principal exports are wood and timber, valued in 1890 at Rs.27,351; the imports, rice, cotton goods, tobacco and sugar, valued in 1890 at Rs.296,344. Exclusive of vessels-of-war, the port was visited in 1890 by 46 vessels of 26,748 aggregate tonnage.

Quarantine.—Vessels arriving from ports proclaimed infected, or themselves infected, are detained in quarantine for from one to

10 days, if inside the harbour. If outside the harbour, vessels are not quarantined, unless they have actual cases of cholera on board.

Supplies of wood, fresh water, beef, and vegetables may be procured.

Communication.—Steam, Rail, Telegraph.—There is steam communication with Colombo and Indian ports by vessels of the British India Company. A coach runs 87 miles to Matale, whence there is a railway to Colombo. Trincomali is connected with Colombo by telegraph.

The Climate of Trincomali differs from that of the south or west coast of Ceylon, bearing a greater resemblance to that of Hindustán southward of Madras. The south-west monsoon, which at Colombo is characterised by extreme moisture, is here experienced as a hot dry land wind, during the continuance of which there are only a few slight showers, and the temperature is comparatively high; while the north-east monsoon is accompanied by heavy rains until the end of January, and a comparatively low temperature. The heat thus follows the course of the sun, but is modified in effect by land and sea breezes. The following table is from observations made at Trincomali at an elevation of 175 feet above sea level.

Month.	Temperature.					Humidity.		Cloud.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Mean.	Inches.	Days.	Mean.	Daily Range.		
				Daily.	Month.								
January -	78	83	74	9	15	77	5·8	6·2	10	29·83	·10		
February -	80	85	75	10	17	74	4·5	2·4	3	—87	·11		
March -	82	88	75	13	20	75	4·1	1·3	4	—84	·12		
April -	85	92	77	15	23	70	4·2	1·6	4	—77	·12		
May -	85	94	77	17	26	67	5·1	2·2	6	—71	·11		
June -	85	93	76	17	25	67	6·2	1·9	4	—70	·09		
July -	85	93	76	17	24	65	5·7	2·2	2	—71	·10		
August -	84	93	75	18	25	68	5·7	4·2	9	—72	·10		
September -	83	92	75	17	24	69	5·7	4·6	7	—74	·12		
October -	81	89	75	14	23	74	6·0	8·9	16	—77	·12		
November -	79	85	74	11	18	82	6·2	13·1	19	—82	·11		
December -	78	83	74	9	15	81	6·4	13·2	23	—85	·11		

The north-east monsoon blows at Trincomali from November until February, and the south-west monsoon from May until August. In the intermediate months, March and April, September and October, south-easterly winds are most common. Calms occur about 4 days in each of the last 4 months of the year.

Back bay, on the north side of the peninsula forming Trincomali harbour, is about 3 miles wide and a mile deep, and may be resorted to during westerly winds; the anchorage in 7 to 10 fathoms, sand, being situated with Flagstaff point bearing from S. by E. to S.E. by S., distant about a mile. During the north-east monsoon, or from the middle of October to the middle of March, Back bay is an unsafe anchorage.

Elizabeth point, the north extreme of Back bay, has foul ground extending eastward from it for half a mile. Heroine rock is small and under water, and lies S.S. E. $\frac{1}{4}$ E., three-quarters of a mile from Elizabeth point. Lively rock appears small and sunken, and bears from Elizabeth point E. $\frac{1}{2}$ N., distant nearly half a mile. It is near the eastern edge of the shallow water extending eastward of Elizabeth point. Standing towards this part of the coast vessels should not bring Flagstaff point eastward of South, to avoid these rocks and those to the northward.

The Pullakulla or Salt lake, connects with the sea at about half a mile south of Elizabeth point; on the south side of the narrow channel leading into the lake, is a hill, 100 feet high, overlooking the sea, having a bungalow on its summit. Nilavelli village, about 8 miles north-west of Trincomali, and near the sea coast, produces much salt.

Rocks.—Fairlie rock, on which a ship of that name struck, and the Diomedé rock, on which H.M. ship of that name grounded, are situated $2\frac{1}{4}$ and 4 miles respectively northward of Elizabeth point, and one and $1\frac{1}{2}$ miles from the nearest shore.*

Pigeon island, 99 feet high, and N. by W. $\frac{3}{4}$ W., $8\frac{1}{2}$ miles from Flagstaff point of Trincomali, is rocky, with a few shrubs on it, and on account of the foul ground surrounding it should not be approached nearer than 2 miles.

Mount Erasmus, 310 feet high, is situated westward of Pigeon island; Pinnacle hill (about 150 feet) having a sharp finger-like peak, is northward of mount Erasmus.

Boulder point, which protrudes slightly, is about 10 miles

* It is possible that the two rocks are identical, as their positions are very doubtful.

north-westward of Pigeon island. Red Cross river mouth is a little north of Boulder point, and at 8 miles further to the north-west, is the entrance of lake Kokelé; about the same distance further north are some conspicuous red cliffs; but between Boulder point and Muletivu, the coast has few distinguishing features, showing a fringe of trees of uniform height, without hills.

MULETIVU SHOALS stretch $3\frac{1}{2}$ to $5\frac{1}{2}$ miles from the coast off Muletivu, 20 miles north-westward of lake Kokelé entrance. They occupy a space nearly 9 miles in extent northward and southward; the depths in the southern part are from 6 to 18 feet, and the northern part consists of knolls with depths from 12 to 24 feet over them. The sea breaks heavily on the northern side of the shoals in the north-east monsoon.

Beacon.—Muletivu beacon, a circular tower with a dome top, about 79 feet high, painted white, and constructed of iron framework and timber, is situated on the south bank and close to the entrance of Vattuvakal Aru river, northward of Muletivu.

The **COAST** between Muletivu and point Pedro trends north-westward, 48 miles, and is low throughout. At Muletivu a bungalow with a red roof, situated in the village, near the beach; and a building with a white cross, about half a mile to the northward, are conspicuous objects from the offing.

POINT PEDRO SHOAL, having over it from $2\frac{1}{2}$ to 4 fathoms, encompasses the north-east part of Ceylon, and stretches parallel to the coast, the south-eastern end of the shoal being about 24 miles S.E. $\frac{3}{4}$ E. from point Pedro.

Between point Pedro shoal and the north-east coast of Ceylon is a channel from 2 to 3 miles wide, having depths of 6 to 7 fathoms soft mud, by means of which Palk bay and the Pambam (Paumben) passage may be reached.

An obelisk 50 feet high, painted white, is situated close to the coast in lat. $9^{\circ} 33\frac{3}{4}'$ N., about 22 miles south-eastward of point Pedro, and when brought to bear W. by S. $\frac{1}{4}$ S., leads southward of the south end of point Pedro shoal in about 7 fathoms water.

Ethiopia shoal, on which the vessel of that name touched in 1878, has a depth of 12 feet, and lies at the south-west or inshore elbow of the southern portion of the point Pedro shoal; from it, point Pedro bears N.W. $\frac{3}{4}$ W., $12\frac{1}{4}$ miles, and Kudaripu (on the coast abreast) W. by S. $\frac{1}{4}$ S. nearly 4 miles.

2 **POINT PEDRO**, a well defined tree bluff on the north-east point of Ceylon, is low. The small town of Purrititori, where there is a Custom house and several bungalows on the beach, lies about a mile westward of the point, and is the chief shipping place of the district. The main staple is tobacco. Three miles westward of point Pedro is Palmyra point having upon it some palmyra trees.

A coral reef fringes the coast from point Pedro to the westward, extending about a quarter of a mile from the shore, being farthest from the beach, at the point itself. Abreast of the custom house at Purrititori, a boat channel has been made through the reef to the beach.

DIRECTIONS.—Sailing vessels from Trincomali proceeding to the north part of Ceylon, inside or south of the Pedro shoal, should keep near the coast steering N. by W. from a position 2 to 3 miles eastward of Flagstaff point until clear of Pigeon island, taking care not to shoal into less than 20 fathoms by day, or 25 fathoms by night. After passing Muletivu shoal in not less than 20 fathoms, the coast to the northward should not be approached nearer than 10 fathoms, until in lat. $9^{\circ} 34' N.$ * Then proceed as necessary, using the white obelisk as a guide for clearing the south tail of the Pedro shoal, and after entering the channel between that shoal and the land, keep along shore at about a distance of $1\frac{1}{2}$ miles. In case of the wind baffling, or at night, if necessary, good anchorage may be had in any part of the channel between Pedro shoal and Pedro point. Vessels should not borrow on the point Pedro shoals, as there may be less water on them than is shown on the chart.

* In 1881, the *Mars* reported having grounded on a bank with 40 fathoms close-to, in lat. $9^{\circ} 8' N.$, long. $81^{\circ} 4' E.$, or about 9 miles from the north-east coast of Ceylon. The report hardly seemed of a satisfactory nature.

CHAPTER III.

PALK STRAIT AND COROMANDEL COAST, PEDRO POINT
AND PALK BAY WITH PÁMBAM PASS TO COCANADA.

 VARIATION 1° TO 2° E. IN 1892.

PALK STRAIT,* so-named after the Dutch Governor who first navigated it, separates Ceylon from the south-east part of the peninsula of Hindustán, and at its entrance, between point Palmyra and point Calimere is about 33 miles in width. The old Dutch navigators mention three passages through the strait, the southern one of which, between the north coast of Ceylon and the shoals which form a middle ground, is the original Palk strait. To the south-west, Palk strait opens out into a considerable sheet of water, stretching about 60 miles in that direction, and about the same distance further to the south-east, known as Palk bay, having over it depths of from 6 to 7 fathoms, with a muddy bottom. Palk bay washes the north coast of Ceylon on its eastern side, and the coast of Tanjore and Madura on its western. The islands of Rameswaram and Manár, with their shoal connection, known as Adams Bridge, form a broken breakwater, at the head of Palk bay, dividing its waters from those of the gulf of Manár; the Pámbam pass between Rameswaram island and the Hindustán coast, making a narrow connecting channel.

There are two recognised entrances into Palk bay; one between point Calimere and the north end of the Middle banks has from 19 to 24 feet of water; the other (Palk strait proper), between the south end of the Middle banks and the north coast of Ceylon, was formerly said to carry $5\frac{1}{2}$ fathoms, but it has been found, that not more than 26 feet at low water, can be reckoned upon in crossing the northern end of the Pedro shoals, in the eastern part of the strait, and near the western limit of the strait, or at about 5 miles north-westward of Kara Tivo island, the continuation of the Middle Ground presents obstructive depths of from $3\frac{1}{2}$ to 5 fathoms at low water. It is recommended, however, that sailing vessels drawing more than 12 feet, should use the southern channel.

* See Admiralty chart :—Cape Comorin to Cocanada, No. 828, and Palk strait and gulf of Manár, No. 68a, scale, $m = 0.24$ inch.

Point Palmyra, about 3 miles westward of point Pedro, the north-east point of Ceylon, may be recognised from north-west or eastward by the palmyra trees growing on it.

Valvettitorai is a small port about $3\frac{1}{2}$ miles westward of point Palmyra.

Tondimanar is a village situated about 8 miles westward of point Pedro. The entrance to the back-water here forms a conspicuous gap when seen from the northward.

Kankasentorai, situated about 5 miles westward of Tondimanar, contains a larger population than point Pedro, and native vessels of considerable size are built here. It is a smooth anchorage during the south-west monsoon, and has recently become of importance, the anchorage off Jafnapatam being fully exposed in that season. The best mark for recognising Kankasentorai is Niramalai, a grove of crab trees about 40 feet higher than the surrounding trees, and visible at a distance of 13 miles. There is a custom house here.

Middle banks.—From a position about 4 miles S.S.E. of point Calimere the Middle banks extend in a southerly direction and join the banks extending northward from the shoals north-westward of Kara Tivo. Middle banks have an average breadth of 3 miles, with uneven soundings of from 2 to $3\frac{1}{2}$ fathoms, and in two places patches of 9 feet. These patches are situated on the bearing of S. 20° E. from point Calimere, distant respectively 6 and $8\frac{1}{2}$ miles, and the bottom is of hard sand. There is generally a swash over the Middle banks, which renders them unsafe for boats, when there is a breeze.

About 13 miles S.S.E. from point Calimere there appears to be a break in the Middle banks, about $3\frac{1}{2}$ miles wide, having depths of from $3\frac{1}{4}$ to $4\frac{1}{4}$ fathoms. No explicit directions can be given for its navigation, nor can the Middle banks be said to have been completely surveyed.

The depths in the channels between point Calimere and the north-west end of Ceylon are not positively known, but it is probable that none of them carries a greater depth than 4 fathoms at low water. For many years the inclination has been for these banks to shoal, and for the navigation to become more difficult.*

DIRECTIONS.—The best passage across the Pedro shoals, carrying depths of about $4\frac{1}{2}$ fathoms, is with Tondimanar gap bearing South, a little westerly. In working into Palk bay against the south-west monsoon, a vessel should stand over to the north coast of

* A depth of 8 feet, on the shoals between Middle banks and the north coast of Ceylon, was reported by the Master of the steam-vessel *Asha* in 1891.

Ceylon, and work down to Nadoen Tivo or Delft island, whence a stretch may be made across the bay to its western side, where land and sea breezes, with smooth water, will be met with.

In the north-east monsoon, a vessel should also work to the northward on the Ceylon side of Palk strait as far as Elewa Tivo (westward of Kayts), when a board may be made over to the western side of Palk bay, and a vessel may then creep to windward in smooth water.

Current in the middle of Palk bay sets to leeward with either monsoon, and it is therefore necessary to take every advantage of smooth water and weather shores as recommended above.

Wind and weather.—In Palk bay, as in the gulf of Manár, the south-west winds generally commence about the middle of April, with fine clear weather. Early in May, the south-west monsoon blows fresh, and continues until about the middle of August, when it moderates, gradually dying away about the end of September; the sky then becomes overcast, and about the 10th of October the north-east monsoon commences with hard squalls from different quarters, accompanied by heavy rain, thunder, and lightning, which weather continues during the month. The wind then becomes steady from the north-east; but during the months of November, December, and January, there are frequent gales and much rain. In the early part of February, the north-east winds take off, and regular sea and land breezes set in, which continue until the middle of March, when calms prevail for several days, and the heat increases until the return of the south-west winds in April.

Kayts harbour or Orratorai, situated between the island of that name and Kára Tivo, off the north-west point of Ceylon, can be entered by vessels of 8 feet draught at high water. The entrance channel lies across the flats extending between Kára Tivo and Elewa Tivo, where there is $7\frac{1}{2}$ feet at low-water springs, with a rise of about 15 inches.

DIRECTIONS.—Making for Kayts harbour, when rounding the north-western part of Kára Tivo, vessels should keep about 2 miles from the coast, until Fort Hammonhiel on the south-west point of Kára Tivo bears S.E. by S., when steer for it, keeping the Custom house point, on which is a large clumpy tree, over the low sandy point of Kára Tivo, till within a quarter of a mile. A vessel will then be in 9 feet, smooth water, and should steer to round fort Hammonhiel at a distance of from one to three cables, care being

taken, when the fort has been rounded, to keep on the north side of the harbour, until past a bungalow, there situated. The best anchorage is off the custom house in about 2 fathoms, mud.

Outside anchorage in smooth water may be obtained off Kayts harbour, in either monsoon, in about 13 feet, with fort Hammonhiel bearing S.E., distant $1\frac{1}{2}$ miles.

JAFNAPATAM, about 8 miles eastward off Kayts harbour, is situated on the north side of a shallow inlet between Mandi Tivo and the mainland of Ceylon. This is the principal town of the vicinity, and the anchorage near it, is approached from the south-east, between Mandi Tivo and Kalmoeene point, but it is only available for vessels of small draught; shoal ground, over which depths of one fathom will be found, lies in the approach, $2\frac{1}{2}$ miles to the southward of the landing place. No trustworthy directions can be given, the chart being the best guide. The inhabitants are principally Tamils. There is a custom house and master attendant. Special regulations are in force as to the hire of boats for landing or shipping cargo.

Anchorage for a large vessel desirous of communicating with Jafnapatam, may be had in $4\frac{1}{2}$ fathoms at a distance of $1\frac{1}{2}$ miles south of the south-east point of Mandi Tivo, but this position is unsafe from the middle of May to the middle of August, when the south-west monsoon, from which there is no shelter on this part of the coast, blows with great violence.

Winds.—The north-east monsoon prevails at Jafnapatam from November to February, and the south-west monsoon from the middle of April to October. During March, and the first half of April, the prevailing winds are south-easterly.

Delft island.—When the north-east monsoon blows fresh into Palk bay, in December and January, small vessels will find good temporary shelter at night on the west side of Nedoene Tivo or Delft island, (the south-western of the islands near the north-west point of Ceylon), in 5 fathoms, mud, with the south end of some high brab trees, E.N.E.

THE COAST of the eastern side of Palk bay forms a considerable double bight between Jafnapatam and Manár island, both parts of which are fringed with foul ground and extensive banks of mud and sand, studded with small islands. Immediately south of Jafnapatam, and between the coast at that place and Kalmoeene point, is the entrance to a shallow lagoon, about 3 miles wide at its mouth, which

extends to the south-east for about 37 miles, finding an exit on the eastern coast of Ceylon, at high water, and effectually insulating the northern part from the main body of the island. There are no ports or anchorage on this part of the coast, for the features of which the chart should be consulted.

MANÁR ISLAND is separated from the mainland of Ceylon by a narrow channel, navigable by boats. The island is about 15 miles in length S.E. by E. and N.W. by W., and its western point bears S.W. by S., 37 miles from Kalmoene point. The south-west face of the island has low sand-hills for about 5 miles; the western end has abundance of cocoa and other palm trees near the villages. The barren sand-drifts of this island are incapable of producing sufficient grain for its inhabitants. The most singular objects are the monstrous baobab trees; one of the largest, at Manár, has been found to measure 30 feet in circumference, although it was little more in height.

The town of Manár is at the east end of the island, amongst coconut trees, and presents an aspect of industry and comfort; its fort, which was built by the Portuguese, and strengthened by the Dutch, is in tolerable repair. Manár was anciently the seat of the pearl fishery, but its importance has greatly declined; a considerable portion of the trade between the east and west coasts of India was carried on through the narrow channel which separates the island from Ceylon, and there were establishments at Mantotti on the mainland, as well as on the island, for unloading and reloading such craft as it was necessary to lighten in order to assist them over the shoals.

Manár port is near the east end of Manár island and is sheltered, but has a south bar and a north bar, at each of which the custom-house boats examine small vessels before entering.

Pesalai is a small port on the north-east side of Manár island, affording good shelter during the south-west monsoon.

ADAM'S BRIDGE.—This barrier is a narrow ridge of sand and rocks, mostly dry, forming the head of the gulf of Manár, and connecting the islands of Rameswaram and Manár. It extends nearly east and west, 16 or 17 miles, and is for the most part composed of shifting sand-banks with small intricate channels between them, in which the average depth is 4 feet at low water. The edge of the bank of soundings is 12 miles to the south-west of Adam's Bridge.

RAMESWARAM ISLAND, lying between Adam's Bridge and the south-east cape of Hindustán, is low and sandy, and well

planted with cocoa-nut trees towards its west end. In length, nearly E.S.E. and W.N.W., it measures 14 miles; its eastern half is a narrow strip of sand, but the breadth of the island, where the great temple stands, is nearly 5 miles. It is uncultivated, and principally inhabited by Brahmans and their followers, who are supported by the profits derived from the temples. The village of Thani Kodi is at the east extreme of the island.

The great Paruvadum temple, or coil, stands on rising ground, on the north part of the island, in a quadrangular enclosure 650 feet broad by about 1,000 feet long, and is entered by a gateway 100 feet high; it is situated about E. $\frac{1}{2}$ N. 5 miles from Pámbam lighthouse. Thousands of pilgrims from India resort here. To the south of the great temple is a fresh-water lake, about 3 miles in circumference. The town of Rameswaram stands north-east of the lake, and south-east of the temple, on the eastern sea-face of the island. The town of Pámbam is built at the western end of the island.

LIGHT.—A *fixed white* light, elevated 97 feet above high water, and visible 12 miles in clear weather, is exhibited from a circular column of masonry, situated on a sand hill about 40 feet in height on the north-west point of Rameswaram island, and three-quarters of a mile eastward of the northern entrance to Pámbam pass.

PILOTS.—The licensed pilots at Pámbam are under the orders of the Master-Attendant. During the south-west monsoon, pilots are stationed on Pulli island, to look out for vessels making Pámbam from the southward.

Rocks awash lie about $1\frac{1}{2}$ miles eastward of the north-east end of Rameswaram island, where the soundings should not be shoaled to less than 5 fathoms. Sailing vessels should take care in the north-east monsoon not to get into the bay to the east of Rameswaram island, as it is difficult to work out again.

Toniturei (Ramen) point.—This narrow tongue of land is the southern point of Madura on the Indian coast, and is rather more than one mile west of Pámbam town. Toniturei temple stands 200 yards within the point.

Kathu Vallimuni reef lies off the north shore of Toniturei, and is $1\frac{3}{4}$ miles in length east and west, and $3\frac{1}{2}$ cables broad; it consists principally of large patches of coral and rock, with several feet of water between them, and dries in parts, at low-water spring tides. There is a boat-channel about half a cable broad between this reef and the main.

Kanthé Thuki reef, $2\frac{1}{2}$ to 4 cables westward from Pámbam lighthouse, is composed principally of coral patches which partially dry at low water. There is a boat channel between the reef and the shore, used by pilots when boarding vessels in the north-east monsoon.

PÁMBAM PASS* is between the west end of Rameswaram island and Toniturei. This channel has been deepened and improved by blasting and dredging, and is used by the coasting craft from Palk strait to the gulf of Manár. The pass is 1,350 yards in length, and varies in width from 52 to 25 yards; the depth in the channel ranges from 10 to 14 feet at low water, but it shoals suddenly on both sides, so that great care is necessary in taking vessels through. It is easier of approach from the northward than from the opposite direction. The pass is to be dredged to a depth of 14 feet at low water throughout. The heaviest draught vessel that has visited the port (1891) was of 15 feet draught.

The principal rocky barrier through which the pass has been made extends in a nearly straight line from Toniturei point to Pámbam. On the west side of the pass it is named the Great dam, and consists of large masses of rock, having a flat surface, which were formerly portions of a causeway that extended from Rameswaram island to the mainland. The north face of the dam at low-water is steep-to, and presents a wall-like appearance, but the boulders are sufficiently separated to allow a free passage to the water at low tide. About 100 yards south of the Great dam, and parallel to it, is another rocky ridge termed the South dam, which shows partially at low water and extends half-way from the pass to Toniturei point. Eastward of the Pámbam pass is a ledge of rocks, evidently once a continuation of the Great dam; it is covered at high water, and there are several patches of rock to southward of it with varying depths of water between. At $1\frac{1}{2}$ cables from Toniturei point, there is an opening in the rocks; it is, however, so small, and has such a rush of water through it, that even fishing canoes never attempt to pass through.

Buoys.—The northern entrance to the pass is marked by a chequered buoy, moored with the lighthouse on Rameswaram E. by S. $\frac{3}{4}$ S., distant $6\frac{1}{2}$ cables. A red buoy is moored in the middle of the pass; and the sides of the channel are marked by posts.

DIRECTIONS.—The approach from the northward to Pámbam pass is clear of dangers; the land, however, in its vicinity is low,

* See Admiralty chart of Pámbam pass, No. 69; scale, $m = 4$ inches.

the only conspicuous object being the temple of Paruvadum, on the northern part of Rameswaram island. This is the first object seen from seaward, and is a good guide for making the port; on a nearer approach to the entrance, the lighthouse forms an excellent mark. The tripod and pass ball in line, near the eastern end of Great dam, lead to the entrance of the pass.

At night vessels may steer for the Pámbam passage, with Pámbam light (visible 12 miles) bearing from S.W. to S.S.E. During the strength of the north-east monsoon (early in November to end of January) Pámbam passage should not be approached at night, it being then unsafe to anchor, owing to the short chopping sea which prevails.

Anchorage.—Vessels should anchor in 20 feet, with the lighthouse bearing S. by E., distant about one mile, and Toniturei temple about S.W. $\frac{1}{2}$ W. The holding-ground, mud, is very good.

PÁMBAM TOWN, situated on the western extreme of Rámeswaram island, consists principally of large-sized huts. There are few Europeans, but of late years, as the traffic through the pass has increased, many native merchants have established themselves at Pámbam. The inhabitants are for the most part fishermen and boatmen, some of whom find employment in conveying coolies to Ceylon, and others in ferrying the pilgrims who visit the temple of Rámeswaram; there is also a large number of coolies employed in hauling vessels through the pass when the wind is adverse, sometimes as many as a dozen vessels being hauled through in one day. The number of coolies annually passing through Pámbam averages about 36,000. The population of the town numbered 4,000 in 1891.

There are no anchorage nor port charges at Pámbam, but customs dues are levied.

Communication, &c.—An occasional steam-vessel runs to Negapatam and Colombo. Pámbam is connected with the telegraphic systems of India and Ceylon. There are no docks or appliances at Pámbam for the repair of vessels; coal cannot be obtained.

Supplies.—Beef and mutton are not easily procurable, goat being the principal animal supplied in the bazár. Fowls and a few native vegetables may be had, fish is plentiful, and good water is easily obtained, but vessels have to use their own appliances.

Trade.—Shipping.—The exports are insignificant; imports principally rice, valued in 1890 at Rs. 146,037. In that year 2,100 vessels visited the port, of 229,724 collective tonnage.

Hospital.—Seamen are admitted to the civil hospital.

Horse-shoe bank.—Southward of Pámbam pass is an extensive sand-bank, which, projecting from the west end of Rameswaram, bends round in the form of a horse-shoe to Toniturei point; the general depths over it are from 2 to 6 feet, and through the loop, at one and a quarter miles from the pass, Sand-bank channel has been dredged to the depth of 10 feet at low water. A red buoy lies at each end of this channel. The beacons on Kúrisuddi island and reef, in line, lead through.

Kundugal point, the south-west point of Rameswaram island, between which and Shingle islets, is the south-eastern channel to Pámbam pass, bears S. $\frac{1}{2}$ E., nearly 2 miles from the lighthouse. The extreme point, which is marked by a beacon, is low and sandy, but cocoa-nut plantations commence a short distance from it, and extend northward and north-east. Eastward of Kundugal point the coast is backed by low sandhills covered with scrub and stunted bushes. A white beacon, 2 miles eastward of Kundugal point, marks the eastern limit of the port.

Pulli, Pullivausel, and Kúrisuddi are three islands southward of Horse-shoe bank, which are completely encircled by Pulli coral reef, the whole forming a natural breakwater that protects the pass and the channels leading to it from the swell of the south-west monsoon. The northern edge of the reef is clearly defined at low water, but its southern edge is much broken into patches, and the sea breaks continually over it. The islands are low and covered with scrub and bushes.

Pulli is marked by a beacon 30 feet high and painted white.

Kúrisuddi, also marked by a beacon, is used as a quarantine station and has a hospital and a few small houses on it. The space between the northern edge of the reef and Pámbam pass forms a sheltered anchorage for vessels of light draught in all weathers.

Puma East channel, between Pulli reef and Horse-shoe bank, is marked at its western entrance by two buoys. A depth of 3 feet at the eastern end of Puma East channel is marked by a post.

Shingle islets, two small islets $1\frac{1}{3}$ miles south-east from Kundugal point, are low, and have a few bushes and shrubs on them. A large beacon, 40 feet in height, and painted white with a broad red band in the centre, has been erected on the eastern islet, and is a good guide to vessels making for the eastern entrance channel. Kallarú reef surrounds the islets, extending one cable eastward, and $3\frac{1}{2}$ cables westward and north-west of them. It is composed of coral, and the sea breaks heavily on its south-west edges.

SOUTHERN DANGERS.—A Two Fathom Patch lies 4 miles S. by E. from Shingle islets, the sea breaks on it with a fresh breeze; the east port-beacon just open eastward of the beacon on Shingle islet, about N.E. by N., leads westward of it. About $2\frac{3}{4}$ miles E. by S. $\frac{1}{4}$ S. from this patch is another having 3 fathoms over it.

A patch of rock lies to the southward of Kúrisuddi island, with Pámbam flag-staff and Kúrisuddi beacon in line, distant one mile from the latter, and has 7 to 8 feet water over it. Another rocky patch with 8 feet over it, lies mid-way in the channel between Kúrisuddi island and the north-west part of Kallarú reef. This passage is seldom used, as the bottom is foul and uneven, and, occasionally, heavy breakers extend the whole breadth of the channel.

Pulli Shoal, $1\frac{1}{2}$ miles S. by E. $\frac{1}{2}$ E. from Pulli beacon, is composed of sand and coral; the general depths on it vary from 8 to 12 feet, but on its north-west part is a rocky patch with only 5 feet over it. The western edge of this shoal lies almost due south of Pulli beacon. With a moderate breeze the sea breaks on the shoal. $\frac{1}{4}$

Manauli islet, lying 7 miles south-westward of Pámbam light-house, is the easternmost of a number of islets, which, with their fringing reefs and intervening banks, lie at some distance off the Madura shore between Toniturei point and Tuticorin, thus sheltering a considerable extent of the northern waters of the gulf of Manár from the swell of the south-west monsoon, and affording convenient smooth water navigation for the coasting craft. A small white beacon stands at the eastern end of Manauli islet.

At $1\frac{1}{4}$ to 2 miles southward of the reef encircling Manauli and Musel islets, are several shoals having $2\frac{1}{2}$ to 3 fathoms water over them. One of these shoal patches, with $2\frac{1}{2}$ fathoms water, lies $2\frac{1}{2}$ miles southward from Manauli, and 3 miles eastward from the southern elbow of the reef.

Manauli reef, extending 2 miles east of Manauli island, is about 7 cables broad, and consists principally of coral and rocky patches; it dries at low water spring tides.

INNER DANGERS.—Kana Parú reef is a coral patch $1\frac{1}{2}$ miles westward of the south extreme of Pulli island; the whole surface dries about one foot at low water. Kolimuruka reef, awash at low water, lies about 7 cables W.S.W. from Kana Parú reef, and nearly the same distance from the northern edge of Manauli reef. Heron reef, less than one mile due west from Kana Parú, is awash at low water. May reef lies $1\frac{1}{2}$ cables north-eastward from Heron reef,

and W.N.W. of Kana Parú ; it is of small extent, and is awash at low water. **Sunken reef.**—This dangerous patch lies $1\frac{1}{2}$ miles north-westward from Kana Parú reef, and about $1\frac{1}{4}$ miles S. by W. $\frac{1}{2}$ W. from Mundapum point ; it has about one foot on it at low water, and is not easily seen during rough weather.

Tides.—It is high water, full and change, at Pámbam, at 1 h. 50 m. ; springs rise 3 feet. During neaps, sometimes for 48 hours, there is a range of only one or two inches.*

The tides are irregular at Pámbam, the rise and fall being affected by the winds. During the north-east monsoon there is less water throughout the whole space southward of the pass, but in the south-west monsoon the reverse takes place, and the level of the water is higher or lower according to the force and continuance of the prevailing winds.

The flood stream enters between Kundugal point and Kúrisuddi island, and sets westward along the face of Pulli reef till it is joined by the stream setting in through Puma channel, thence it takes a northerly direction, but is weak except during strong winds.

The currents of Pámbam are generally influenced in strength by the force of the wind. Through the pass, the current frequently attains a velocity of from 5 to 6 knots, rendering it at times difficult to take even steam-vessels through. During the north-east monsoon the current sets to the southward, and in the south-west monsoon to the northward. The only months in which a decided tidal stream is noticeable, are March, April, and October, when it generally sets for 6 hours each way.

DIRECTIONS.—When approaching Pámbam from the southward caution is necessary, as the islands fringing the coast are very low, and there are no hills or conspicuous landmarks to guide the navigator ; during the south-west monsoon a thick haze frequently hangs over and obscures these low islands.

The first objects distinguishable from seaward are Pámbam light-house and the beacons on Pulli island and Shingle islet.

Vessels making for Puma channel, between the island of Pulli and Manauli reef, should be guided principally by the eye, as the reef off Manauli is clearly visible ; it has deep water one cable off it all round, and the sea always breaks on its south and east sides. Pass about 2 cables eastward of Manauli reef, and then steer to pass $2\frac{1}{2}$ cables westward of Pulli reef. If bound for the pass, as soon as

* The tides are subject to a diurnal inequality, which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot.

the beacon of Kundugal point is in line with the north-west point of Pulli island, haul in for the south buoy at the entrance of Puma East channel, care being taken to pass close to the buoy, in order to avoid the 8-foot patch lying 3 to 4 cables W. by S. of it.

In making for Puma channel from the eastward, care should be observed not to shoal under 3 fathoms, so as to avoid Pulli shoal and the reef off Pullivausel, which extends $3\frac{1}{2}$ cables from its south point.

In making for Kundugal channel, which is by far the best entrance, vessels should not shoal under 4 fathoms till Pámbam lighthouse shows just open eastward of Shingle islet beacon, when they may steer for the east port-beacon, being careful not to approach the reef off Shingle islets nearer than 3 cables. Vessels may haul in for the anchorage off Kundugal when the beacon on that point bears W. by N. $\frac{1}{2}$ N. The anchorage is about 2 cables southward of Kundugal point, but care must be taken in approaching it to avoid the shoal ground that stretches 2 cables south-eastward of the point.

Vessels approaching Pámbam from westward and passing between the islands and the coast of Madura, should, when abreast Manauli island, keep a good look-out for the reefs of Kolimuruka and Kana Parú, and steer in about mid-channel between them and Manauli reef. These reefs all show well, and have deep water close-to.

WINDS.—During October, south and south-west winds prevail and occasionally blow strong; towards the end of the month variable winds are experienced, which last till the early part of November, when the wind sets in steady from northward and eastward, and, with few exceptions, blows strong for the remainder of the month. The wind during December is much the same as that of November, veering, however, more to northward, whilst heavy squalls of rain and wind are of constant occurrence. During January and February, the north-east wind is more moderate; it is light in the morning, but sets in strong about noon as a sea breeze, and falls again at sunset. March is one of the finest months at Pámbam, the north-east wind being light and variable. In the morning the wind sets in from eastward, having a tendency to shift to the southward, but by noon it backs to eastward, in which direction it lasts till sunset, when it gradually dies away. Occasionally south and south-west winds blow for a day or two, but the prevailing wind in March is from the north-east. April is a most uncertain month, the wind blowing from all quarters, no two days the same. Squalls of wind and rain are experienced, all tending to show the approaching change of monsoon. The south-west monsoon occasionally sets in during this month.

THE COAST of the western and northern sides of Palk bay is low and level, and extends in a double bight from the Pámbam pass to point Calimere, a distance of 73 miles. The southern bight forms the eastern shore of the province of Madura, the northern bight the south coast of Tanjore. The whole of this coast is without harbour or inlet, and is of commercial interest to native trade only. The river Vaigai, on which is the town of Madura, enters Palk bay at Attankarai about 14 miles westward of the Pámbam pass. The 3-fathoms line extends seaward from the west side of Palk bay for a distance of from 4 to 5 miles, the nature of the bottom consisting of sand and sometimes mud. About 45 miles northward of Pámbam a shoal with depths less than 3 fathoms extends 15 miles eastward of a low point on the western shore of Palk bay.

Devipatam, a coast town 22 miles N.W. by W. of the northern entrance to the Pámbam pass, is an emigration depôt, from which, during the south-west monsoon, natives are conveyed to Manár island. Small vessels anchor in $1\frac{1}{2}$ to 2 fathoms, sand and mud, with the town of Devipatam bearing West, distant about 2 miles. During the north-east monsoon Devipatam has no safe anchorage.

Tondi is situated about 17 miles N.N.E. of Devipatam, and is of some commercial importance, trade being carried on by native trading vessels. Anchorage may be obtained here in 3 fathoms, mud, with the town of Tondi bearing W.N.W., distant $3\frac{1}{2}$ miles, but exposed to all winds with easting in them. Small vessels anchor nearer the shore in from 10 to 18 feet, stiff mud.*

Kottaipatam, a coast town $17\frac{1}{2}$ miles north-eastward from Tondi, may be distinguished by a single tree and plantation of high palmyras. The best anchorage, about 3 miles from the shore, is in $2\frac{1}{2}$ to 3 fathoms, with the single tree and plantation of high palmyras in line, bearing W. by N.

A sand spit, with from one to 3 fathoms over it, stretches E. by S. for a distance of about 15 miles from a low point, which protrudes to the eastward, about 5 miles to the northward of Kottaipatam. A heavy swash of the sea generally prevails over this sand spit, which should not be approached from the eastward nearer than a depth of 6 fathoms. From a position in 3 fathoms off its eastern extreme, Pámbam bears S. 22° W. distant $44\frac{1}{2}$ miles, and point Calimere N. 50° E., distant $29\frac{1}{2}$ miles.

* The master of the steam-vessel *Aska* reported, in 1891, a depth of 10 feet, sand, at low water, in a position $3\frac{1}{2}$ to 4 miles south-eastward of Pasipatam mosque; and a depth of 14 feet in the same direction from the mosque, and with Tondi Custom House, W. $\frac{1}{2}$ S., 7 to 8 miles.

Tides.—It is high water, full and change, at the Sand spit, at 11h. ; approximate rise and fall 15 inches.

Shallavenaikapatam pagoda,* in lat. 10° 16' N., 6 miles south-westward of Adrampatam, is a high column situated near the coast, visible from seaward for a distance of 15 miles. This pagoda is the most conspicuous object on the western shore of Palk bay.

ADRAMPATAM.—From the low protruding point from which the sand spit just described extends, the coast curves in to the northward for about 20 miles to the coast town of Adrampatam, from which place considerable native trade is carried on with Ceylon and the ports in southern India. Adrampatam is considered a port of refuge for native vessels between the months of May and September.

Anchorage in 20 feet, soft mud, may be obtained off Adrampatam with the town bearing North, and Shallavenaikapatam pagoda bearing W. by N. ; but small vessels approach the coast much closer. With south or south-east winds a heavy swell sets on to this coast, rendering the anchorage insecure, but in the north-east monsoon it is considered good.

DIRECTIONS.—From the eastward, after having cleared the shoal water extending southward from point Calimere, and the shoals between that point and Ceylon, a good course will be W. by N. with Shallavenaikapatam pagoda right ahead, in about 4 fathoms, at a distance of about 5 miles from the shore, anchoring as convenient according to the vessel's draught.

The coast from Adrampatam trends E. $\frac{3}{4}$ S. for 29 miles to point Calimere, and consists of mud flats covered with mangrove bushes, the whole being overflowed during heavy rains and high spring tides.

POINT CALIMERE forms the northern point of entry to Palk bay and the southernmost point of the Coromandel coast. A beacon erected in 1849 on the south-east extreme of the point, is now surrounded by water, owing to the encroachment of the sea. About $2\frac{1}{3}$ miles westward of the point are the Kodigeri bungalows, formerly much resorted to during the hot weather. At about $5\frac{1}{2}$ miles N.N.W. from the point, and a mile inshore, are two dark looking pagodas, in shape like oblong haystacks, which when in line bear West. A sand bank, dry at low water, inside which trading boats find shelter in bad weather, extends about 2 miles N.E. by E. of Calimere beacon.

The 3-fathoms bank extends about 5 miles E.N.E. and S.S.W. from point Calimere, and 2 miles south-eastward. There are also

* Erected in 1814 by the Rajah of Tanjore.

detached sand patches with less water in the vicinity, for the position of which, the seaman is referred to the chart.

LIGHT.—A *fixed pale red* light, elevated about 55 feet above high water, and visible in clear weather 6 miles, is exhibited from a steel mast (about 45 feet high) on point Calimere.

DIRECTIONS.—In rounding point Calimere from the eastward, by the channel north of the Middle bank, and immediately south of point Calimere, the position of a vessel may be obtained by cross bearings of the two pagodas to the northward of the point, and of the beacon, prior to shaping a south-westerly course clear of the 3-fathom coast bank on the north side, and a detached 2-fathom patch on the south. A depth of more than 20 feet, cannot, however, be relied upon. Daylight is essential for navigating in this locality, and careful attention should be paid to the lead.

THE COROMANDEL COAST† (a name of doubtful origin), is the term generally applied to the south-east part of the shores of the peninsula of Hindustán, between point Calimere on the south, and the mouth of the Kistna river on the north, a distance of about 365 miles. It is divided into the districts of Tanjore, South Arcot, Madras, Chengalpat, North Arcot, and Nellore. The whole coast is low and sandy, and exposed to a tremendous surf, the artificial harbour of Madras alone affording shelter for European shipping. To the north of Sadras (about 40 miles southward of Madras), the sea appears to have encroached upon the coast to a considerable extent.

THE COAST from point Calimere trends N. $\frac{3}{4}$ W. for about 28 miles to Negapatam; it is low, and fringed with groups of palmyra and casuarina trees; it should not be approached nearer than a depth of 7 to 8 fathoms, which will be found about 8 miles off shore, the water deepening near Negapatam. The two dark-coloured pagados 5 miles northward of point Calimere, already alluded to, and a sand hill about 20 miles northward of that point, with a white house on the beach close to its north side, are the only distinguishable marks between point Calimere and Negapatam. This sand hill, bearing West, leads northward of Negapatam shoal.

Negapatam shoal, composed of hard sand and stones, having over it less than 3 fathoms, is situated nearly 4 miles from the shore, in lat. $10^{\circ} 36' N$. Between the shoal and the bank which fringes the

† See Admiralty chart :—Coromandel coast, sheet 4, Madras to Point Calimere. No. 71*d*.; scale, $m = 0.25$ inch. Also, sheet 3 from lat. 13° to $15^{\circ} N$., No. 71*c*; and sheet 2 from lat. 15° to $16^{\circ} 30' N$., No. 71*b*.

shore the water deepens to 4 and 5 fathoms, thus forming a narrow channel, used by native boats.

Shoals.—Three small sandy shoals lie outside the 5 fathoms line, and about $2\frac{1}{2}$ miles off shore between Negapatam and Nagar. The southern shoal with a depth of 27 feet lies with Negapatam light-house W. by S. $\frac{1}{2}$ S., $2\frac{1}{6}$ miles. The middle shoal has 30 feet water, and lies with the lighthouse S.W. by W. $\frac{1}{2}$ W., $2\frac{3}{4}$ miles. The northern shoal also has a depth of 30 feet, and lies with the lighthouse S.W. $\frac{1}{2}$ W. $3\frac{1}{6}$ miles.

NEGAPATAM, one of the first Portuguese settlements on the Coromandel coast, but which became Dutch in 1660 and English in 1781, is the principal seaport of the Tanjore collectorate. It is situated at the mouth of the small river Kaduveiyaru forming part of the Vedarániam canal, which extends for a distance of $35\frac{1}{2}$ miles to a salt swamp of that name; salt being stored in large quantities at Negapatam. The limits of the port are defined by boundary pillars.* A vessel of 26 feet draught has entered at Negapatam. The population in 1891 was 58,848.

LIGHT.—A *fixed white* light, elevated 80 feet above high water, visible seaward through an arc of 180° , or from the bearing of North to South, and seen in clear weather a distance of 14 miles, is shown from a white pillar of masonry, situated near the Custom house at Negapatam.

Signals are shown from this light-house. For Storm Signals, see pages 27, 127.

Landmarks.—The minaret at Nagar, with its main tower 148 feet high, and four smaller towers, the lighthouse, and two chimneys of the South Indian Railway workshops, afford conspicuous marks for fixing a vessel's position when making Negapatam. There are also two large Hindu temples, one in the centre and one in the south-west part of the town.

DIRECTIONS.—Sailing vessels bound to Negapatam, in the south-west monsoon, round the north end of Ceylon, should not stand into less than 20 fathoms near Pedro shoal. Any vessels making the coast southward of Negapatam should not shoal to less than 8 fathoms in standing towards the coast, or the Middle banks, and the lead must be kept going. In the north-east monsoon sailing vessels should steer to make the land northward of the port, as the current

* See plan of Negapatam and Nagar anchorages, on Admiralty chart, Madras to point Calimere, No. 71d.; scale, $m = 1.75$ inches.

then runs strongly to the southward and into Palk bay. After sighting Nagar minaret it should not be brought to bear northward of N.W. by N., to avoid Negapatam shoal and the shoal water northward of it.

Anchorage off Negapatam is exposed to all but westerly winds, the holding ground, mud, is good, and the water between 4 and 5 fathoms shoals gradually. In bad weather, a short broken sea gets up. Vessels may anchor according to their draught of water and the state of the weather; in the fine season, with the lighthouse bearing from W. by N. to S.W. and, Nagar minaret from N.W. to N. N.W. $\frac{1}{2}$ W., in $3\frac{3}{4}$ to 6 fathoms, will be found a good position. During the north-east monsoon it is advisable not to anchor in less than 5 fathoms, and in putting to sea from Negapatam during that season, it should be remembered, that the current runs strongly to the southward into Palk bay and towards the north coast of Ceylon; sailing-vessels will therefore require a press of sail to enable them to clear the Ceylon coast.

Tides.—It is high water, full and change, at Negapatam at 8h. 40m. Springs rise $2\frac{1}{2}$ feet, and neaps $1\frac{1}{2}$ feet.

Current off Negapatam does not appear to be affected by the tide, but to depend upon the direction and force of the wind, with which it generally sets.

River and Bar.—The filling of the river at Negapatam every year by the freshets, felt in July, causes an opening off the end of the jetty, which gradually works to the southward, as the river begins to fall. About December a sand spit forms, and gradually increases until early in July, when it nearly blocks the river's mouth. The changes described occur regularly. In very fine weather, ships' boats can cross the bar without danger, although with the risk of a wetting; a steer oar is indispensable. The entrance to the river at Negapatam mentioned in former sailing directions, about a cable south of the present mouth, has been blocked up, for the purpose of increasing the scour over the existing bar.

Communication by rail and telegraph exists with all parts of India. Emigrants and coolies leave in large numbers for the Straits Settlements, and coal and stores for the South Indian Railway, of which Negapatam is the terminus, are here landed. There is communication by steamer, with Madras twice a week, with Bombay, Calcutta, Rangoon and Ceylon weekly, and with the Straits Settlements three times a month.

Supplies of fresh meat, bread, and water can always be obtained; also fruit and vegetables.

Repairs.—Heavy repairs to machinery can be executed in the foundries of the South Indian Railway Company. Boats drawing 4 feet can unload at high water, at a crane situated on the bank of the river, one cable south of the lighthouse.

Trade.—Shipping.—The exports are rice, ground nuts, oil cake, and ghee, of an aggregate value in 1890 of Rs. 6,673,447. The imports are grains, pulse, areca nuts, timber, coal, and iron materials, of an aggregate value in 1890 of Rs. 4,108,577.

In 1890, the port was visited by 830 vessels of about 600,000 total tonnage.

Coal.—About 6,000 tons are kept in stock by the South Indian Railway Company. Coal is shipped by cargo boats, each carrying about 5 tons.

Quarantine.—When a vessel has cholera or smallpox on board the flag *R* of the International code is to be hoisted at the foremast.

Hospital — Seamen are taken as in-patients at the Civil Dispensary.

NAGAR (Nagore), situated $3\frac{3}{10}$ miles to the northward of Negapatam, on the south bank of the river Vettár, was ceded to the English by the Rajah of Tanjore in 1778. It is remarkable for its mosque and minaret already mentioned, the latter is visible from seaward before the coast is seen. An annual feast held here is largely attended by pilgrims. The population is chiefly Muhammedan, and there is a considerable trade carried on by native vessels with Burma and the Straits settlements.

The Vettár river at Nagar is about one cable in width, but blocked by islets and shoals, and obstructed by a shifting bar, having over it about 4 feet, similar to that at Negapatam.

Anchorage, though open, affords good holding ground, and vessels can approach the shore nearer than at Negapatam. The north bank of the Vettár river defines the northern limit of the port of Nagar; to the south the port joins that of Negapatam.

KÁRIKAL,* the capital of a French territory of 52 square miles, is situated on the north bank of the river Arselár, more than a mile from the beach, about 5 miles north of Nagar. The coast hereabouts is very low, with a few fishing villages. The rivers Koluncherri and

* Chiefly from remarks by M. Fribourg, late harbour master at Kárikal, published in French Hydrographic Notice, No. 12 of 1881.

Tirumali, both like the Arselár, barred streams, find their way into the sea between Kárikal and Nagar. These rivers can only be navigated after the heavy rains have sufficiently swollen their streams, when cargo may be landed in flat bottomed boats. Kárikal is a straggling town numbering about 92,000 inhabitants, of whom about 200 are Europeans.

LIGHT.—From the flagstaff on the north side of the mouth of the Arselár river, at an elevation of 45 feet above high water, is exhibited a *fixed white* lantern light, which should be visible in clear weather from a distance of 8 miles.

Signal Station.—The above flagstaff, standing on a white pediment, and generally flying the French flag, is situated $1\frac{1}{2}$ cables inland from the beach. Vessels can communicate with this flagstaff by means of the International code.

Landmarks.—From the southward, vessels should sight the high minaret of Nagar ; from the northward, the dome of the church and the flagstaff are the first conspicuous objects seen on approaching Kárikal.

Anchorage off Kárikal is said to be the best on the Coromandel coast, the bottom, of muddy sand, affording good holding ground.

In the south-west monsoon, anchor in from $4\frac{3}{4}$ to 6 fathoms, with the flagstaff bearing W. $\frac{1}{2}$ S. During the north-east monsoon in $4\frac{3}{4}$ to 7 fathoms, with a long scope of cable, the flagstaff bearing West.

The current follows the direction of the coast, and varies according to the monsoon ; the maximum rate reaching as much as 3 to 4 miles an hour.

Landing.—The lading and unlading of cargo is carried on with little difficulty in the river. The bar, which is marked by rollers, is very dangerous in the months of October, November, and December. Landing should not be attempted with ships' boats ; there is a well-organized native boat service under the harbourmaster. The depth of the mouth of the river is 8 feet at spring tides.

Signal.—A blue flag hoisted on the flagstaff at Kárikal indicates "the bar is heavy," and all communication prohibited.

Trade, consists of rice, cocoa-nut oil, sesame, coir, and piece goods as exports ; the imports are sugar, sulphur, teak and sandal wood.

Winds.—The north-east monsoon begins in October and ends in March ; the south-west monsoon begins in March and ends in October. The changes of the monsoons are usually accompanied by bad weather. Cyclones are rare, but if one visits this locality it usually

occurs near the middle of November, or beginning of April. The rainy season commences towards the end of June and ends at the latter part of November.

TRANQUEBAR purchased from the Rajar of Tanjore by the Danes in 1616, and bought by the English in 1845, is situated on the north bank of a river, navigable only for native boats, about $6\frac{1}{2}$ miles north of Kárikal. The old fort of Dansborg, the white houses, flagstaff and look-out tower, render it recognisable from the offing. A small grove of casuarina trees flanks the south side of the town. The sea has encroached considerably in this vicinity, and abreast the fort, protective stone groyne, which should not be approached too closely in boats, extend about a cable seaward.

Anchorage may be had with Tranquebar flagstaff bearing W. by N., in from $5\frac{1}{2}$ to 6 fathoms, about $1\frac{1}{4}$ miles from the shore. At night, approaching from the southward, endeavour should be made to sight Kárikal light.

Landing.—Cargo is landed and shipped from the beach abreast the custom house in masula boats, carrying about 4 tons. During the north-east monsoon, there is about 6 feet at high water on the bar of the river, when native craft of about 150 tons enter for repairs.

Trade and Supplies.—The principal articles of export are twist, piece goods, coir, and spices. Poultry, bread, meat, and vegetables are procurable in small quantities. Fresh water for shipping is obtainable from the river during the freshes, from July to December.

THIRUMALAVASAL in the Tanjore district, about 13 miles northward of Tranquebar, is a small town with a pagoda situated near the mouth of a river, one of the many branches of the Cauvery. To the southward of Thirumalavasal, distant about 6 miles, is Cauverypatam with two pagodas. The land northward of this begins to rise slightly; it having been very low and flat between point Calimere and Cauverypatam.

Flagstaff.—A flagstaff for signalling purposes, 75 feet in height, stands 35 feet northward of the custom house, a low tiled building on the western bank of the river, at Thirumalavasal.

Anchorage.—Two boundary pillars on the coast mark the northern and southern port limits. Vessels should anchor with the flagstaff bearing from West to W.S.W., in 5 to 6 fathoms of water,

Caution.—The anchorage should be approached with caution, as the soundings shoal rapidly inside the 5 fathoms line.

Coleroon river, the south boundary of the South Arcot district, discharges itself into the sea about 12 miles northward of Thirumalavasal. The vicinity of the entrance may be recognised by a thick plantation of trees, known as Coleroon wood, higher than the surrounding land, and which appears from seaward like an island. The four Chillumbrum pagodas, situated about 7 miles inland from the mouth of Coleroon river, in lat. $11^{\circ} 24'$ N., are remarkable buildings, but not seen when approaching from the southward until open clear of Coleroon wood, on the bearing of W. by S. $\frac{1}{2}$ S.

Coleroon shoal, the inner part dry at low water, extends about $1\frac{3}{4}$ miles north-eastward of the entrance to Coleroon river, and has depths of 3 and $4\frac{1}{2}$ fathoms on its outer edge, with 11 and 12 fathoms close to seaward.

When the south Chillumbrum pagoda opens of Coleroon wood, a vessel is abreast of the south end of Coleroon shoal, and when the Porto Novo flagstaff bears W. by N. she is northward of the northern and most dangerous part of the shoal.

Porto Novo, a name given by the Portuguese, situated on the north bank of the Vellar river in latitude $11^{\circ} 29'$ N., bears about N.W., distant 4 miles from the outer edge ($4\frac{1}{2}$ fathoms) of Coleroon shoal. The depth of water on the bar of the Vellar, which is a broad shallow stream, is 3 feet at low water to $4\frac{1}{2}$ feet at high water spring tides. Cargo is landed here at a jetty opposite the custom house. Native craft enter the river for repairs. A dépôt for salt is established at Porto Novo. The Danes and Dutch formerly had factories here, and the extensive iron foundry, at present idle, has been worked by more than one company; ore of a fine description being found in Coleroon river. Small supplies for shipping are obtainable at Porto Novo. A remarkable description of mat, from leaves of the wild pine apple, is made here.

Directions.—Ships should not close the coast at night nearer than 5 miles, which will be in 17 fathoms, and at daylight in proceeding towards the anchorage from the southward Coleroon shoal should be avoided, and a depth of 12 fathoms maintained until the flagstaff at Porto Novo bears W. by N., then steer for the roadstead.

Anchorage.—From about the middle of October to near the end of December, vessels should anchor about 3 miles from the shore in 9 fathoms. During the first burst of the north-east monsoon

native craft avoid this port, in consequence of Coleroon shoal then being to leeward of the anchorage.

In the south-west monsoon vessels anchor about 2 miles from the land in 5 to 6 fathoms, with the southern of the Chillumbrum pagodos bearing S.W. $\frac{1}{4}$ W., and Porto Novo flagstaff W. $\frac{1}{2}$ N.

CUDDALORE, on the backwater formed by the confluent estuaries of the Guddilam and Paravanur rivers, is the principal port of the South Arcot district, and is about 13 miles northward from Porto Novo; the coast between being low, with occasional sand hills, appearing from the offing like small islands.

LIGHT.—A *fixed red* light, visible seaward from north to south, elevated 130 feet above high water, 31 feet from the ground, and seen 7 miles in clear weather, is shown from the flagstaff at Cuddalore.

Cuddalore flagstaff is on a sand hill, with a white building and church southward of it. To the northward of the town, distant about 2 miles, are the ruins of fort St. David, the south end of which is visible from seaward through a gap in the casuarinas.

A small white pillar, on a sand hill near the fort, marks the northern limit of the port. The bar of the Guddilam river has about 3 feet over it at low, and 5 feet at high water. Cargo boats discharge at a jetty up the river near the custom house. Vessels of 200 tons have occasionally entered the river for repairs; mud docks can be cut here by the natives.

Anchorage may be obtained in 5 or 6 fathoms, with Cuddalore flagstaff bearing N.W. by N. This position is most convenient, as it gives the shortest distance for boats to traverse to the mouth of the river.

Trade and Supplies.—Paddy, rice, indigo, hides, and ground-nut oil form the exports, and areca nut and pepper the chief articles of import. The value of exports is about 30,000*l.*; population about 41,000. The town is well laid out and considered healthy. Bread, meat, poultry, vegetables, fruit and water, are procurable for shipping.

PONDICHERRI,* or Punducheri, the capital of the French possessions in India and residence of the governor, is situated 13 miles to the northward of Cuddalore, and in latitude 11° 55' N. The town is divided into two parts, the White town and the Black town, separated from one another by a canal. The White town, having its streets shaded by avenues of trees and built at right angles to each

* See plan of Pondicherri on Admiralty chart, No. 71*d*, scale, *m* = 2 inches.

other, is a model one, and possesses many fine buildings, the whole presenting a picturesque and imposing appearance from seaward. The district of Pondicherri has an area of 112 square miles, and had a population of 172,941 in 1891. The revenue is valued at about 40,000*l*.

From the offing, Pondicherri may be recognised by the land on the north side and at the back of the town, being higher than in the neighbourhood of Madras or Negapatam. Within the sandhills, about 4 to 6 miles northward of Pondicherri, is some red land, about 100 feet high, with a few trees on it. Northward of this the shore is low, with sandhills about 30 to 40 feet high. The cathedral at Pondicherri, standing 300 yards southward of the lighthouse, is conspicuous, having two square towers with a cupola on the west side. At times there is almost a total absence of surf on the shore. A screw pile pier, at which ships' boats can land during the fine season, has been constructed for landing and discharging cargo. The quarantine and port rules are stringent.

LIGHTS.—From a white masonry tower, near the beach at Pondicherri, is exhibited at an elevation of 89 feet above high water, a *fixed white* light, visible in clear weather from a distance of 15 miles.

From a mast at the extremity of the landing stage a *fixed red* light is shown at a height of 31 feet above the sea, visible in clear weather 4 miles.

When the surf is heavy and approach to the landing stage prohibited, a *fixed green* light is exhibited from an elevation of 26 feet, visible from a distance of about 3 miles.

Signal stations.—Both the town flagstaff, and the flagstaff at the port office, are signal stations, with which vessels may communicate by means of the International code.

Note.—The local signals and the regulations of the port are delivered to merchant vessels immediately on arrival, and the directions therein should be strictly complied with.

In case of a vessel not answering signals made to her from the port, attention is drawn by guns being fired. The signal for a boat is answered by a blue pennant at the port office.

Quarantine.—No communication is allowed with the shore, or with any vessel or boat in the roadstead, until pratique has been granted; unless the vessel arriving is in danger, when the other vessels are bound to send assistance to her, whether she has been granted pratique or not.

Anchorage.—In the north-east monsoon, vessels should anchor in 8 to $9\frac{1}{2}$ fathoms, about $1\frac{3}{4}$ miles from the shore, with the lighthouse bearing W.N.W. to N.W. by W., and ride with about 70 fathoms of cable. Precautions should be taken against bad weather.

In the south-west monsoon anchor in 7 to 8 fathoms, with the lighthouse bearing W. by N. to N.W., at the distance of about a mile from the shore. The sea at this time is generally smooth, but a long scope of cable is recommended, as the south-east wind occasionally prevails with considerable strength. In the changeable squalls there is danger of vessels colliding; a secure and open berth should therefore be selected.

Tides.—It is high water, full and change, at Pondicherri at 8h. 25m. Springs rise $3\frac{1}{2}$ feet and neaps $2\frac{1}{2}$ feet.

Winds.—The south-west monsoon continues from about the middle of March to October, the north-east from about the middle of October until March. The season of gales begins in October, and lasts to the end of December. In January, the sky is usually clear, and the north-east wind fresh; in February the wind draws more to the eastward until the middle of March, at the end of which month it blows from south-east by day and south-west during the night.

DIRECTIONS.—During the north-east monsoon (October to March), sailing vessels from the southward should keep near the middle of the bay of Bengal until they make the coast in the latitude of Sadras ($12^{\circ} 30' N.$), the locality of which may be known by the hilly land behind it; thence they can easily run down the coast to Pondicherri, keeping in 12 to 15 fathoms. Gales at this season are not unusual at Pondicherri; they generally begin at north-west, making the round of the compass through north and east. Vessels are thus enabled to get away from Pondicherri to the south-eastward. After a gale the wind generally veers round to south-east, and fine weather prevails.

During the south-west monsoon, vessels from the southward should make the coast in the vicinity of Kárikal or Tranquebar, and whilst steering northward to Pondicherri remember the northerly set of the current. At this period the land wind is sometimes very strong and gusty, and changes rapidly in direction and force, but seldom lasts long.

Supplies and Landing.—Supplies for shipping can be obtained at Pondicherri. There is a resident British consul. Landing should not be attempted in ships' boats. The small river which flows through the town admits native craft only.

Trade.—Pondicherri was visited in 1890 by 313 vessels of 361,254 aggregate tons. The principal exports are ground and other oil nuts; and the imports, wines, brandy, dried vegetables, coriander seeds, and areca nuts. In 1890 the imports were valued at Rs.9,054,030; and the exports at Rs.14,699,432.

Hospital.—Seamen are admitted to the Colonial hospital.

Communication.—Various lines of French steam vessels call at Pondicherri, and those of the British India Company afford communication with the United Kingdom, &c., and all the coast ports, fortnightly. The town is connected with the Indian telegraph system.

THE COAST from Pondicherri continues its N. by E. $\frac{1}{2}$ E. trend for 6 miles, and then takes the direction of N.E. by N. for 31 miles to the mouth of the Palar river, which is a considerable stream, draining a large tract of country, and receiving many tributaries, but like the other rivers on this coast, has a bar at the entrance, which is completely closed in the dry season. The nature of the country continues low and sandy, except at from 4 to 6 miles northward of Pondicherri, where there is some red land about 100 feet high, dotted with trees. A thick grove of lofty casuarina trees, northward of Allamparwa river, forms a dark conspicuous object on a fine night. The mouth of this river, which is barred, is situated 22 miles northward of Pondicherri.

The coast bank between Pondicherri and the mouth of the Palar river, has depths of about 5 fathoms at the distance of a mile from the beach.

CHENGALPAT (the brick town) district, between lat. $12^{\circ} 13'$ and $13^{\circ} 54' N.$, notwithstanding its extent of coast line, has, besides Madras, only three ports, Covelong, Ennore, and Pulicat; the coast boat traffic being carried on with Madras by means of a canal and backwater.

Palar river, the entrance to which is in about lat. $12^{\circ} 28' N.$, has a bar, the breakers on which extend nearly half a mile seaward. A plantation of lofty cocoa-nut trees stands on the north side of the river, and a thick wood of palmyras trees stands at the back of the sandhills midway between Allamparwa and Sadras.

Sadras, from which the trade has completely fallen away, although in former years a flourishing Dutch settlement, is situated 5 miles N. by E. of the mouth of the Palar river in lat. $12^{\circ} 32' N.$ The town, which lies low, is almost completely hidden from seaward by trees; there is also a ruined fort in the vicinity.

Sadras hills, N.W. $\frac{1}{2}$ W. 8 to 10 miles from Sadras town, are of irregular outline and not difficult to recognise. Finger peak, 483 feet high, and the south-eastern hill of the cluster, is so named from the appearance of the temple on its summit.

THE COAST from Sadras continues to trend N. by E. $\frac{1}{2}$ E. for nearly 17 miles to Covelong, northward of which it recedes slightly, and then extends for 18 miles in a N. by E. direction to Madras. Between Sadras and Covelong vessels should not stand into less than 15 fathoms water, as there are several rocky patches near the coast, especially northward of Tripalúr reef.*

LIGHT.—Mahábalipúr.—A *fixed red* light, elevated 116 feet above the sea and visible 10 miles, is exhibited from a small gray turret, 26 feet high, situated on the conspicuous rock (the ruined pagoda of Mahábalipúr) about 6 miles northward of Sadras, and half a mile from the coast.

Tripalúr reef, having rocks awash at low water, extends for about a mile from the shore, abreast Mahábalipúr light and the Sadras hills. This danger should not be approached nearer than a depth of 15 fathoms. Of the seven pagodas of Mahábalipúr, that on which the lighthouse stands is the only one conspicuous from seaward, the others being more or less hidden by trees.

Rockingham patches, with a least depth of 11 feet, lie $1\frac{1}{4}$ miles off shore, and $4\frac{1}{2}$ miles north-eastward of Tripalúr reef. From the outer edge of the patches, where the depth is $3\frac{1}{2}$ fathoms, rock bottom, Covelong point bears N. $\frac{1}{2}$ E., and Mahábalipúr lighthouse S.W. by S. Vessels should not stand into less than 15 fathoms near these patches.

Covelong,* in lat. $12^{\circ} 47' 30''$ N., is a village situated near the south bank of a river which here finds its outlet into the sea, and which connects with Sadras by backwater, and with Madras by canal. The whereabouts of the village may be distinguished by a church and a few European bungalows, this place having been more resorted to in former years. There is also a Government salt depôt, and vessels sometimes load with that commodity for Calcutta. A conservator, who is the superintendent of customs, is resident at Covelong.

Tirupórrur hill, 132 feet high, with its summit crowned by a temple, is situated S.W. $\frac{1}{2}$ S., 5 miles from Covelong.

* H.M.S. *Investigator*, in 1887, obtained a sounding of 1700 fathoms, ooze, in lat. $12^{\circ} 44' N.$, long. $80^{\circ} 54' E.$, where a depth of 5 fathoms had previously been marked on the charts.

Covelong point is conspicuous, situated south of the fort and village, and has a plantation of casuarina trees near it. Some projecting rocks awash, extend nearly half a mile north-eastward from the point, forming a small bight, in which there is landing for ships' boats during the south-west monsoon. In passing Covelong point, bound to or from Madras, the lead should be frequently cast, as the soundings have been reported irregular in the vicinity, and the depths found suddenly to decrease from 7 to $4\frac{1}{2}$ fathoms, owing to stone ballast having been thrown overboard from ships in former years.

Anchorage in 7 fathoms may be obtained with Covelong bearing W. $\frac{1}{4}$ N., distant about $1\frac{1}{2}$ miles from the shore.

Landmarks.—About 10 miles south-westward of Madras, and 6 miles inland, are the Pallavaram hills; St. Thomas mount, 120 feet high, recognisable, in approaching Madras from the southward, by the flagstaff, church and buildings on its summit, is situated $2\frac{1}{2}$ miles north-eastward of the Pallavaram hills. The military cantonment of St. Thomas is at the foot of the mount. Two miles nearer Madras, is a smaller elevation, known as the Little Mount. The most conspicuous building in Madras, from seaward, is the new post office, situated near the inner end of the southern breakwater; the towers of this building are visible at a distance of 15 to 17 miles.

MADRAS,* standing close to the sea on a low and sandy coast swept by a strong current and exposed to a heavy surf, is unfavourably situated either for commerce or the requirements of a capital. Its railroads and artificial harbour however, obviate the natural disadvantages it labours under, and it ranks third among the ports of India in respect of its maritime trade. The approach from the sea presents low flat sandy shores to the north and south, with a few small hills inland, and exhibits a striking appearance of barrenness, but the prospect improves on closer inspection. The town, which stretches along the shore, and with its suburbs, covers a distance of nearly 8 miles, and runs $3\frac{1}{2}$ miles inland, has about half a million inhabitants, and is the seat of the Governor and Council of the Presidency of Madras. Fort St. George, in the middle of which stands the original fort, built in 1639, is a strong handsome fortress which rises within a few yards of the sea, nearly a mile southward of the harbour. Southward of the fort stands the earliest church, and northward the Exchange and lighthouse. The Choultry plain, on which Government house is built, commences about $1\frac{1}{4}$ miles

* See plan of Madras roadstead, scale, $m = 3$ inches, on Admiralty chart No. 71c.

south-west of fort St. George, from which it is separated by two small rivers. There are consular agencies for all the principal states of Europe.

LIGHTS.—On the esplanade, about 2 cables northward of fort St. George, is a granite tower 125 feet high, from which is exhibited, at an elevation of 128 feet above the sea, a *flashing white* light showing a flash about every *two minutes*; the flashes and eclipses are irregular in duration, but the proportional time of light to darkness is as 2 to 3; the light is visible in clear weather from a distance of 20 miles.

Leading lights.—The front light shown from the end of the pier in the middle of the harbour, is a *fixed red* light, visible through an arc of 112° , or from S.W. $\frac{1}{2}$ W. to N. by W. $\frac{1}{2}$ W.; it is elevated 30 feet above high water, and should be seen 5 miles. The rear light, shown from the roof of the Port office, is a *fixed green* light, visible through an arc of 112° , or from S.W. $\frac{1}{2}$ W. to N. by W. $\frac{1}{2}$ W.; it is elevated 60 feet above high water, and should be seen 5 miles.

These lights in line lead through the harbour entrance, and are intended to guide vessels leaving the harbour, or making the outer anchorage, at night.

MADRAS HARBOUR, commenced in November 1875, is formed by two breakwaters, each about 7 cables in length, extending for about $4\frac{1}{2}$ cables at right angles from the shore, and then curving towards each other, leaving a passage nearly a cable in width leading to the enclosed area of about 200 acres of water, averaging in depth from 3 to 7 fathoms. When finished the harbour is expected to accommodate from 13 to 14 ships of deep draught, besides smaller vessels.*

A pier 1,350 feet in length, with a T shaped head, projects from the shore about midway between the two inner ends of the harbour breakwaters. At its extremity is a depth of $3\frac{1}{2}$ fathoms. Vessels cannot lie alongside this pier. Ships' boats can ply to and from the pier in safety except in bad weather when a masula boat† should be

* The breakwaters would probably be completed in 1891. Between 1878 and 1890, the high water coast line southward of the south breakwater advanced seaward at the rate of 60 feet per annum.

† The surf at Madras, outside the harbour, breaks at 300 feet from the shore in fine, but at 450 feet in squally weather. During gales from the eastward it is said to break at a distance of 1,000 feet from the beach. There are two lines of surf between which it is possible for a boat to remain without crossing either, the outer of these, or male surf, is the most formidable. With the land wind off shore the surf is often very high, but at that time there is only one slow heavy roller. In ordinary weather the surf wave is 2 to 4 feet high, in rough weather 6 feet, and during a gale 12 to 14 feet.

employed. Railway lines are laid along the pier, which has facilities for landing passengers as well as cargo.

The deepest draught vessel that has entered the harbour, to May 1891, was of 27 feet draught. Vessels of any draught can enter the harbour at all times of tide.

When the harbour is full, steam vessels are admitted in rotation as they arrive, using their own anchors, cables, and stern fasts. Vessels are usually moored head to the eastward, with two anchors ahead, and the stern secured to a buoy.

Regulations.—No vessel is allowed to enter or leave Madras harbour without a pilot or harbour master unless authority to that effect has been given in writing by the conservator of the port. Vessels about to leave are to hoist flag N (International code) at the fore, and if about to enter, flag F of the same code. No more than one vessel may leave or enter the harbour at the same time.

PILOTS.—Steam vessels arriving at Madras should not approach the entrance of the harbour too closely, but wait for a pilot in not less than $9\frac{1}{2}$ fathoms of water.

At night, vessels should anchor in 10 fathoms until daybreak.

Buoys.—Two buoys mark the entrance to the harbour; the southern one, painted red and surmounted by a tripod, is moored 33 yards westward of the end of the remains of the old south pier. The northern buoy, painted black and surmounted by a tripod, is moored 33 yards westward of the remains of the old north pier.

Two buoys, painted red, are moored northward of the harbour, for the use of vessels discharging cargo of a description which is not permitted to be discharged inside the harbour. The southern buoy lies in 5 fathoms water, $2\frac{1}{2}$ cables northward of the north pier, with Madras lighthouse bearing S.W. by S. The northern buoy lies in 5 fathoms water, 6 cables northward of the north pier, with Madras lighthouse bearing S.S.W. $\frac{3}{4}$ W.

ANCHORAGE.—Madras road is open to all winds except those from the westward or off the land, and there is generally a swell tumbling in from seaward, making vessels labour or roll considerably. Large vessels should anchor in 9 fathoms, nearly 2 miles from the shore, northward of the line of the lighthouse bearing West. All sailing vessels, except coasting craft, should anchor outside the depth of $8\frac{1}{2}$ fathoms. The bottom in many places is stiff mud, from which it is difficult to extricate the anchors. In the bad weather season anchor well out, and keep all ready to proceed to sea at a moment's.

notice, for cyclones generally commence at north-west, with which an offing can be gained before the wind shifts to north-east and east, when it would be impossible to get away.

No ballast may be thrown overboard off Madras in less depth than 12 fathoms. From the 15th of April to the 15th of June, and from the 1st of October to the 31st December, sailing vessels are prohibited from anchoring in less than 9 fathoms, and are compelled to have their topgallant masts struck. Cyclones have occurred in April and May, but are not frequent, and if a vessel is ready to weigh or slip and run to seaward at the approach of a gale, there is little danger to be apprehended; but vessels remaining at anchor are likely to be driven on shore. A scope of cable of at least 60 fathoms is recommended, a second anchor should be ready for letting go, and anchors should be buoyed. The limits of the port are marked to the north and south by boundary pillars, and extend to the eastward to a depth of 10 fathoms.

Prohibited anchorage.—Vessels are prohibited from anchoring in any part of Madras roadstead southward of the line of the light-house bearing West, in order to prevent injury to the submarine telegraph cable. No vessel should come into less than 9 fathoms at night.*

DIRECTIONS.—From February to September, sailing vessels bound to Madras should endeavour to make the land to windward or to the southward, sighting the Sadras hills, on account of the strong northerly current then prevalent.

From September to the end of January the land should be sighted to the northward, Kettle Bottom hill in latitude 13° 25' N., about 30 miles westward of Pulicat, is said to be a good mark at this period, or at night the fixed white light of Pulicat. Approaching Madras from the northward, vessels should not bring Madras flashing light to bear to the southward of S.S.W. $\frac{1}{2}$ W., and proper attention should be paid to the lead.

Tides.—It is high water, full and change, at Madras, at 8h. 35m., springs rise 3 ft. 7 ins., neaps 2 ft. 4 ins. The tides are subject to diurnal inequality which may retard or accelerate the times of high and low water, and increase or diminish the rise by as much at times as one foot. In October, November, and December, the mean level of the sea is one foot higher than from February to May.

* In a greater depth than 9 fathoms renders a vessel liable to extra boat hire; and if in more than 10 fathoms, outside the limits of the port.

TIME SIGNALS.—About 1,300 yards northward of the lighthouse at Madras is the Master Attendant's office, from the flagstaff on the roof of which, a semaphore is dropped at 8h. a.m., Madras mean time, equivalent to 14h. 39m. 0·6s. Greenwich mean time; and again at 2h. p.m. Madras mean time, equivalent to 20h. 39m. 0·6s. Greenwich mean time.* When the semaphore drops incorrectly, the signal (C.V.N.J.) *failed*, in the International code is hoisted, and kept flying for half an hour, and the semaphore lowered by hand. The semaphore is extended at right angles to the staff 5 minutes before the signal is made.

In addition to the above signal, a gun is fired by electricity from a battery near the lighthouse, at noon, Madras mean time, equivalent to 18h. 39m. 0·6s., Greenwich mean time.

WIND, WEATHER, AND CURRENT.—The following table of wind, weather, and current prevalent on the Coromandel coast applies more particularly to the neighbourhood of Madras:—

Months.	Wind.	Force.	Current.	Force.	Remarks.
January -	N.E. to E.N.E. veering to East.	Steady and fresh.	South-west-erly.	1 to 2 knots.	At middle and end of January land and sea breezes at northern part of the bay of Bengal.
February -	N.E. veering to S.E. and South.	Light.	South-west-erly in early part of Feb., towards end of month begins to set to north-ward.	Weak.	Out in the bay of Bengal strong current to south both in January and February.
March and April.	S.S.E. to S.S.W. decreasing at sunset, and succeeded by land winds from S.W. to W.N.W.	Strong. } Not strong nor steady.	North-east-erly following direction of coast.	Strong at times 3 knots an hour.	In April, squalls occasionally from the N.W.
May -	South to S.W. veering towards the land at night.	Abating in strength.	North - east-erly.	At times 1 to 2 knots.	In May north-east winds often experienced, ending at times in a cyclone. Barometer should be watched, especially if wind set in at N.N.W. veering to North. At night (early part) squalls off the land from N.W.
June -	S.S.W. to W.S.W.	Steady and increasing	North-east-erly in early part of month, but begins to set to south-ward in-shore at latter end.	Weak. } Weak.	In June S.W. winds along the Coromandel coast, and over the bay of Bengal generally.

* Allowing Madras observatory to be in long. 80° 14' 51" 3 E. To this observatory all Indian longitudes are referred, it stands about 2½ miles S.W. by W. ½ W. from Madras lighthouse.

Months.	Wind.	Force.	Current.	Force.	Remarks.
July and August.	S.W. to W.N.W. and West.	Strong, with rain and overcast sky.	South-westerly or contrary to the wind.	Strong, 2 to 3 knots at times.	By keeping inshore, in July and August, vessels from north to south have made good passages.
September.	W.S.W. to West and W.N.W.	Decreasing in strength.	South-westerly.	Strong.	In September, N.E. winds sometimes for two or three days together.
October.	W.S.W. to N.W. then calms. N.E. towards end of month.	Light. { At times light, at others strong, with rain and cloudy weather	South-westerly.	Not strong.	October an uncertain month liable to cyclones. A very low barometer does not always accompany strong winds. A stormy sky should not pass unheeded.
November and December.	N.N.E. to N.E.	Strong and steady.	South-westerly, and to southward.	About 1 knot an hour.	November and early in December unsettled. Caution necessary. Hurricanes and cyclones often occur in November, and even in early December.

CYCLONES.—The Madras cyclones usually commence with the wind from N.N.E. to N.N.W., the wind changing to the eastward or westward as the port may be left in the right or left hand semicircle of the storm. (*See* pages 21 to 27.)

Sailing vessels should have best sails bent, and top-sails and courses close reefed. The ground swell has invariably the tendency to cast a vessel inshore on parting or slipping, and as this is a dangerous contingency, precaution should be used to have a spring on the cable to cant the ship's head seaward. With a north-west wind at Madras, the centre of the storm would bear about East. A vessel should therefore stand S.S.E. (not S.E.) or along the coast until in the latitude of Pondicherri or Cuddalore, and then heave-to on the port tack, thus obtaining a clear drift first to the eastward, and then with the rapid shifting of the wind to the westward, back to port. But to carry out these directions a vessel should leave early in the storm; in fact, on seeing or hearing the signal that a storm is approaching, at once, as every hour is of importance.

Vessels in ballast, or discharging cargo such as iron, timber, &c. had better shift out into 11 or 12 fathoms of water on the approach of a gale, and have two anchors down, veering as much cable as possible, striking upper masts and yards, and securing cargo from shifting. This method of riding out a cyclone has been successfully accomplished.

STORM SIGNALS.—In addition to the general Storm Signals

for the ports of Bengal, *see* page 27, the following special signals are shown at the ports of the Madras Presidency :—

Day signal.—A *cone*, apex upwards, at the flagstaff of the port, indicates that it is decided the shipping shall be ordered to sea, and signifies *cut or ship*.

Night signal.—*Three bright lights* placed *triangularly*, one at the masthead, and one at each yard-arm of the flagstaff of the port, indicates that it is decided the shipping shall be ordered to sea, and signifies *cut or ship*.

Boat signals.—Government recall flag for a vessel leaving Madras is the English red ensign at the master attendant's flagstaff. A white pendant with red centre (C of International code) is the recall flag for all boats. A Union Jack should be hoisted at the fore when an accommodation boat is required, a wheft for a cargo boat, and flag B. of International code for a catamaran ; Union Jack under the red ensign for the police boat.

Supplies are plentiful. Fresh water is laid on by pipes to the end of the pier from the “seven wells” (two only now in use yielding about 260,000 gallons a day) at the north end of Black town.

Coal.—About 1,000 tons are usually kept in stock, and it can be put on board at the rate of 150 tons per day. It is shipped in bags from boats carrying 2 to 3 tons each.

Repairs to engines of 500 nominal horse-power have been effected ; cylinders of 30 inches diameter can be cast and bored, shafts of 26 inches diameter forged and turned, and boilers 25 feet by 7 feet made or repaired. There are two cranes, one capable of lifting 20, the other 10 tons. No repairs can be executed to hulls of vessels.

Communication.—Madras is connected with the Indian Railway and telegraph systems. *See* page 16. There is weekly communication by British India steamer with Calcutta, Rangoon, Colombo, Bombay, and coast ports. And fortnightly communication by P. and O. steamer with Bombay, Colombo, and Calcutta.

Trade-shipping.—The exports are indigo, cotton, hides, ground nuts, jaggery, and coffee ; all valued in 1890 at Rs. 54,063,184. The imports are coal, iron, machinery, Manchester goods, explosives, and railway stores ; all valued in 1890 at Rs. 66,585,549. In 1890 the port was visited by 700 vessels of about 1,000,000 total tonnage.

Quarantine.—No quarantine is enforced at Madras unless a vessel has infectious or contagious disease on board.

Hospital.—Seamen are treated at the General Hospital.

Sailors' Home.—There is a small Sailors' Home at Madras.

Population of Madras in 1891 was 400,000.

Climate.—The general character of the climate of Madras is dry, except in October and November, and the temperature is high all the year round. The following table is from observations taken at Madras at an elevation of 22 feet above sea level

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Cloud.	Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January -	76	85	68	17	26	72	4.1	1.0	3	29.99	.12
February -	77	87	68	19	28	71	2.8	0.3	1	—97	.13
March -	81	90	72	18	29	73	2.5	0.4	1	—91	.14
April -	85	93	77	16	27	72	2.9	0.6	1	—82	.13
May -	87	98	81	17	32	67	3.9	2.2	3	—74	.13
June -	88	99	81	18	31	61	6.5	2.1	10	—70	.12
July -	86	97	79	18	28	64	7.1	3.3	14	—72	.12
August -	85	95	77	18	27	69	6.4	4.4	14	—75	.13
September -	84	94	77	17	28	70	6.2	4.7	11	—77	.13
October -	81	89	75	14	25	77	6.2	10.8	14	—84	.13
November -	78	85	72	13	25	79	6.3	13.7	14	—92	.12
December -	76	83	70	13	23	77	5.4	5.1	9	—98	.11

THE COAST.—About 3 miles northward of Madras, plantations of casuarina trees commence, and extend to Ennore; a dense high tope of these trees stands about midway between the two places.

ENNORE is situated nearly 9 miles northward from Madras, at the mouth of an extensive backwater, which here finds its way into the sea. Ennore, which is connected by canal and carriage road with Madras, is resorted to by the European community of Madras. Salt is obtained here, but is a Government monopoly. Vessels bound to Ennore must enter and clear at Madras.

Ennore beacon, 9 miles N. by E. $\frac{1}{4}$ E. from Madras lighthouse, is a white obelisk situated on the beach, with its summit 54 feet

above high water. During the forenoon, when the sun shines on it, the beacon is conspicuous; in the afternoon it is not easily distinguished.

Anchorage off Ennore may be had in $6\frac{1}{4}$ to 7 fathoms, about one mile from the shore, with the tiled bungalows on the beach on the south bank of the river, W.N.W.

Ennore shoal, a sand bank, with depths less than 3 fathoms on it, projects $1\frac{3}{4}$ miles from the coast in a north-easterly direction, at $2\frac{1}{2}$ miles northward of Ennore beacon.

PULICAT SHOALS consist of a chain of hard sandy patches having over them depths of from $2\frac{1}{4}$ to $3\frac{1}{4}$ fathoms. The southern patch, on which there is a depth of $2\frac{3}{4}$ fathoms, lies N. by E. $\frac{3}{4}$ E. $6\frac{3}{4}$ miles from Ennore beacon, and $1\frac{3}{4}$ miles from the coast; from this patch the shoals extend in a N.N.E. direction for about 3 miles; the northernmost patch, which has $3\frac{1}{4}$ fathoms on it, lies S.E. by E. $\frac{1}{4}$ E. $4\frac{3}{4}$ miles from Pulicat lighthouse.*

Kettle bottom hill in line with Pulicat lighthouse, West, leads northward of Pulicat shoals; and Madras principal lighthouse S.S.W. $\frac{1}{2}$ W. leads eastward of Pulicat and Ennore shoals.

The passage between Ennore shoal and the southern patch of Pulicat shoals is not recommended, and nothing would be gained by using it.

Caution.—In the vicinity of these shoals a proper attention should be paid to the lead, and the water should not be shoaled to less than 15 fathoms.

Current.—The current near the Pulicat shoals is feeble, and runs parallel to the coast.

THE COAST between Ennore and Pulicat, a distance of 11 miles, protrudes slightly, trending a little to the westward, and is low, sandy, and backed by an extensive plain which is densely wooded near the beach. Inland, distant about 30 miles from the coast, are the Nágari hills, near to which is a remarkable table land, known as Kettle Bottom, which bears nearly due west from Pulicat lighthouse. About 6 miles south-west of Kettle Bottom is a sharp hill with crooked summit, not so high as Kettle Bottom, and known as Nágari Nose.

* A shoal, with a depth of 4 fathoms, was reported by the S.S. *Clan Macintosh*, in 1884, as lying about 5 miles off-shore, eastward of Ennore shoal; and in 1889, a steam-vessel, drawing 19 feet, was reported to have touched on a shoal lying $3\frac{1}{2}$ miles off-shore and 3 miles southward of Pulicat shoals. These shoals were unsuccessfully searched for by the officers of the Indian Marine Survey in 1887 and 1890; and they have been expunged from the Admiralty charts.

PULICAT, 11 miles northward of Ennore, stands on an island at the south end of Pulicat lake, which is a salt water lagoon about 36 miles long and from 2 to 10 miles broad, forms part of the inland water communication of this part of the coast, and is connected with Madras by Cochrane's canal. The lake is separated from the sea by a low sandy beach, through which there are some openings, and is supposed to have been formed by the sea breaking over the low coast during a cyclone. Pulicat is generally considered the southern limit where the Telugu language is spoken. The Dutch formed a settlement here in 1609, and it came into the possession of the English in 1795. The population is about 5,000. Of late years the trade has declined; formerly the trade with the Straits Settlements was considerable.

LIGHT.—On the narrow sandy peninsula opposite Pulicat and on the site of the old flagstaff, is a tower 57 feet high, painted in alternate horizontal bands of black and white, from which is exhibited, at an elevation of 68 feet above the sea, a *fixed white* light, visible in clear weather from a distance of 14 miles.

Anchorage.—Vessels bound to Pulicat anchorage from the southward should pass outside the Pulicat shoals, and keeping the lead going, not come into less than 15 fathoms of water by day; nor by night, bring Madras light to bear anything south of S.S.W. $\frac{1}{2}$ W., until Pulicat light bears West, when it may be steered for, and anchorage picked up with the light on that bearing about $2\frac{1}{2}$ miles from the shore, in $6\frac{1}{2}$ to 7 fathoms.

NELLORE DISTRICT has 16 ports, or open roadsteads, where cargo is shipped, and the custom house authorities have so arranged that the north limit of the one forms the south limit of the next. None of these ports are of much importance. They consist as follows, commencing from the south: Púdi, Arneghon, Túpili, Pamanji, Kistnapatam, Maipaud, Pomapudi, Isakapalli, Juvaladinai, Tamalapenta, Conaypalem, Ramiapatam, Pakala: after which a break occurs, then come Itamukla, Kottapatam and Kameparti which is connected with Kottapatam. The chief of these are Kottapatam and Kistnapatam.

POINT PÚDI, bears N. $\frac{7}{8}$ W., about 22 miles from Pulicat lighthouse; the coast between is low, with a few crab trees, and forms a shallow bight, with soundings of 5 and 6 fathoms about a quarter of a mile from the beach. At point Púdi, a sandy shoal, having over it from one to $2\frac{1}{4}$ fathoms, extends for $2\frac{1}{4}$ miles in a S.S.E. direction; the outer edge of this shoal, having depths of 4 fathoms, is distant a mile from the coast. Point Púdi is composed

of low sand hills, with a small but thick grove of trees, a little to the southward of it.

LIGHT.—Armeghon.—Close to the coast, N.N.W. $\frac{1}{4}$ W. 7 miles from point Púdi, and near the village of Miniapolliem, is a white stone column 111 feet in height, from which, at an elevation of 107 feet above the sea, is exhibited a *revolving white light*, attaining its greatest brilliancy every *twenty seconds*, and visible in clear weather from a distance of 14 miles.

ARMEGHON, where a factory was established in 1625, is now a small village the resort of salt makers. It is situated near the north end of Pulicat lake, about a mile from the coast, and bears N.N.W. $\frac{1}{2}$ W. $13\frac{1}{2}$ miles from point Púdi, the coast between trending in about the same direction.

Armeghon shoal extends from near point Púdi for about 10 miles in a northerly direction, with depths over it from $1\frac{3}{4}$ to 3 fathoms; the south extreme of the shoal lies 2 miles N. by E. from point Púdi. The eastern edge of the shoal is nearly 6 miles from the coast; with the 10-fathoms line (outside which the depths increase rapidly) 2 miles farther eastward. From the shoalest part ($1\frac{3}{4}$ fathoms), which sometimes breaks, Miniapolliem (Armeghon) lighthouse bears W. $\frac{3}{4}$ S., and here the shoal is about 2 miles in breadth.

DIRECTIONS.—The lighthouse at Miniapolliem is the best landmark near Armeghon shoal. Armeghon hill in lat. $14^{\circ} 1' N.$ about 8 miles inland, is a low table land with a pagoda near its centre, and seldom visible from the outer part of Armeghon shoal. In approaching this vicinity, vessels must not rely on sighting the land, which is often obscured by haze, but sound frequently, and avoid approaching the coast nearer than a depth of 20 fathoms.

The current, though generally governed by the wind is at times irregular; constant astronomical observations, as well as sounding, are therefore recommended when in the neighbourhood of Armeghon shoal.

BLACKWOOD HARBOUR, sometimes called Armeghon roads, lies between the inner edge of Armeghon shoal and the coast, and has depths of from 4 to 6 fathoms good holding ground, over a space about 3 miles in width, east and west, by 10 miles in length.

Directions.—Strangers should keep in 12 fathoms until Miniapolliem lighthouse bears S.W. by S., or Armeghon hill W. $\frac{1}{4}$ S., and then steer direct for Armeghon hill, passing northward of Armeghon shoal

in about 6 fathoms. The anchorage is in 5 fathoms, tenacious clay, with Miniapolliem lighthouse bearing between W. by N. and W.N.W. A convenient anchorage during the south-west monsoon, is with Miniapolliem lighthouse, bearing W. $\frac{1}{2}$ N., distant about $2\frac{3}{4}$ miles.

Middi river, with a village of that name near its mouth, enters the sea in lat. $14^{\circ} 15' 30''$ N., or at about a distance of 15 miles to the northward of Armeghon river. About midway between is the entrance to the Suvarnamukhi river, which, with its tributaries, drains a large tract of country ; but neither the Middi nor the Suvarnamukhi can be entered by any but small vessels. Kistnapatam on the north bank of the Middi river is the shipping port of Nellore, with which town it is connected by road. The trade is chiefly in salt.

Anchorage.—Vessels occasionally anchor outside the mouth of the Middi river in 5 or 6 fathoms, about 2 miles from the beach, but this anchorage is only safe during fine weather. The anchorage in 7 fathoms, mud, 4 miles off shore, is said to be good ; and that in a gale there is no swell there. The entrance of the river, which leads to extensive backwaters, is always open, and is made use of by the dhonies or native trading craft ; it is said to have a depth of 6 to 11 feet at high-water spring tides.

THE COAST from Middi river trends N.N.E. 7 miles to Kautapilli, and then about North for 16 miles to the mouth of the Pennair river, and throughout is low and sandy. The Shallinger sand, having over it depths of from 1 to $2\frac{3}{4}$ fathoms, extends in a N.N.E. direction from the coast between the mouth of Middi river and Kautapilli for a distance of about 10 miles. It has not been closely examined, and the eastern or seaward side of this sand being steep-to, should not be approached nearer than in a depth of 10 fathoms.

Pennair river is one of the largest in southern India, but like others on the east coast, its outlet is so shallow that only native craft can enter. On the south bank of the Pennair river, about 13 miles from the coast, stands the town of Nellore on rising ground, near to which numerous Europeans reside. The mouth of the river which is situated in about lat. $14^{\circ} 38'$ N., is not easily discerned from seaward, as in the last reach, the river trends to the northward, in which direction it enters the sea behind a sandy point, which is only a few feet above water.

Anchorage off the Pennair river may be obtained in fine weather and off-shore winds, in from 5 to 7 fathoms, at a distance of from $1\frac{1}{2}$ to 2 miles from the coast ; sand and mud.

The coast from the mouth of the Pennair river trends nearly N.N.W., and continues its low and sandy nature.

Isakapalli, situated $8\frac{1}{2}$ miles N.N.W. of the mouth of the Pennair river, may be recognised from seaward by a ridge of moderately high land at the back or westward of it, visible about 20 miles.

Grain and other produce is exported from Isakapalli, and a bungalow is maintained by Government for the use of the masters of ships ; granaries and go-downs are on the beach.

Anchorage may be obtained off Isakapalli in 7 or 8 fathoms, sand and mud, about a mile from the beach, westward of a bungalow situated half a mile south of the village. Vessels should anchor northward of the line of the flagstaff bearing West, as a shoal spit extends about half a mile, southward of that line. The holding ground is good, but a heavy surf runs on the beach. Cargo is taken from ships by the fishermen of the neighbouring villages. Bread and other necessities, except a few sheep and a small quantity of fish, have to be obtained from Nellore, distant 23 miles. Large steam and sailing vessels occasionally visit Isakapalli.

Ramiapatam.—The coast continues its N.N.W. trend, and is low and sandy from Isakapalli for 18 miles to the northward, at which distance, in lat. $15^{\circ} 3' 30''$ N. is Ramiapatam, where there is a small native trade, the principal article of export being gunny. This part of the coast is safe to approach as near as a depth of 8 fathoms.

KOTTAPATAM, at which an extensive trade in grain, oil-seeds, &c., is carried on by sea, is the chief and northernmost port in the Nellore district, and has a population of about 5,000. It is situated 23 miles northward of Ramiapatam, the coast between continuing low and sandy. Singaroya pagoda on a hill of moderate elevation, about $3\frac{1}{2}$ miles inland from the coast, near the entrance of the Mun Air river, is the only landmark between Ramiapatam and Kottapatam ; but Chimakurti peak, 2,098 feet high and N.W. by W. $\frac{1}{2}$ W., about 23 miles from Kottapatam, is often visible in the afternoon, when neither Singaroya pagoda nor Pillore hills can be distinguished. There are a few cargo and fishing boats here, which may be hired at fixed rates for discharging cargo ; also catamarans.

Beacon.—An obelisk, of a dark gray colour, surmounted by a flagstaff, the whole 56 feet in height, is situated close to the Custom house at Kottapatam, and is visible from all directions seaward.

Anchorage of a temporary nature may be obtained during fine weather with the go-downs at Kottapatam bearing W.N.W. in 5 fathoms, about $2\frac{1}{2}$ miles from the shore.

Vessels approaching Kottapatam should not shoal the water to less than 10 fathoms, until one of the landmarks above given has been identified.

Communication.—Steam-vessels of the British India Company call at Kottapatam, and it is connected by a good road with Ongole, which has railway communication with all parts of India.

Mutapolli bank, the least water on which, a small patch of $2\frac{3}{4}$ fathoms, lies E. $\frac{1}{4}$ S., $8\frac{1}{2}$ miles from Kottapatam, has irregular depths of $4\frac{1}{2}$ and 5 fathoms, with a hard bottom, and is generally marked by overfalls. From the shoalest patch the low land of the coast is scarcely visible even in clear weather, and the Pillore hills, which bear nearly due West, are seldom seen, being 18 miles distant.

A shoal of $2\frac{1}{2}$ fathoms lies E. by N. about 4 miles from Kottapatam, and is apparently formed on an extension of the coast bank of soundings.

DIRECTIONS.—The northern part of Mutapolli bank bears S.W. $\frac{3}{8}$ W. 33 miles from False Point Divi, and is safe to approach to a depth of 10 fathoms. Mutapolli bank should not be approached nearer than in 14 or 15 fathoms by day, nor 30 fathoms by night, and the lead should be kept going, as the soundings decrease suddenly from 30 fathoms.

KISTNA DISTRICT is the next north to that of Nellore, with a coast line of about 95 miles. The port limits of this district extend about half a mile on each side of the various landing places, and the ports are ten in number,—Mutapolli, Budduranipalem, Iperpalium, Nizámpatam, Gangadipalem, Kottapalem, Nagayalanka, Moratota, Penumudi, Masulipatam.

Mutapolli village, from which the bank just described takes its name, is situated in lat. $15^{\circ} 42'$ N., or about 17 miles N.N.E. of Kottapatam. There is a grove of detached palmyra trees near the landing place, and with the aid of a telescope a small pagoda may be distinguished. A small river here finds its way into the sea, skirting near its mouth, a low sand hill, to the southward of Mutapolli. The coast from here northward is generally known as the Golconda coast, although in the Kistna district.

Iperpalium, in lat. $15^{\circ} 46' 30''$ N., and 25 miles N.N.E. $\frac{1}{2}$ E. of Kottapatam, is a minor port, from which a considerable quantity of oil seeds are exported. It might be recognised by a small grove of brab trees near the beach, and a few buildings which constitute the town.

Anchorage.—The best off Iperpalium is in 4 to 5 fathoms, sand and mud, with the centre of the town bearing W.N.W.

NIZÁMPATAM, is $16\frac{1}{2}$ miles N.E. by E. $\frac{1}{2}$ E. from Iperpalium. The coast between, which is low, trends to the eastward towards False Point Divi, and is safe to approach to $4\frac{1}{2}$ and 5 fathoms by day. The entrance to the river may be known by a small sand hill on its western bank. To the eastward of this river is the grove of Petapilli, which extends along the head of the bay formed between Nizámpatam and False Point Divi. There is a large native trade here.

FALSE POINT DIVI, in lat. $15^{\circ} 45'$ N., bears about S.E. by E. 12 miles from Nizámpatam river entrance, and is low, covered with small mangrove jungle, and has shoal ground fringing it and extending seaward from 3 or 4 miles, where the soundings are from $2\frac{1}{4}$ to 3 fathoms, gradually increasing to 6 fathoms about 6 miles off shore. This bank extends the whole way to point Divi to the northward.

Kistna river takes its rise about 40 miles from the Western Gháts at Mahábaleshwar in the Bombay Presidency, flows across the peninsula of Hindustán in an easterly direction, and after a course of about 800 miles, discharges itself into the bay of Bengal by several branches, one of which finds its outlet near False Point Divi. The district takes its name from the river, which is considered useless for navigation by sea-going vessels.

POINT DIVI, in lat. $15^{\circ} 57' 30''$ N., and forming the continuation of the coast northward of False Point Divi, is low, with a few trees, and has a narrow sand spit extending from it about 2 miles in a south-east direction. Another mouth of the Kistna river here finds exit into the sea.

LIGHT.—From a column coloured white, 50 feet high, situated on the eastern bank of the river near point Divi, and S. 7° W. $9\frac{3}{10}$ miles from Masulipatam flagstaff, is exhibited a *fixed white* light, at an elevation of 48 feet above the sea, visible between the bearings of North through West and S.W., and which should be seen in clear weather from a distance of about 14 miles.

Caution.—Considerable changes are reported to have taken place in the depths off the mouths of the Kistna river, and in the configuration of the adjacent coast line, since the last survey was made. The charts should be used with caution.

Tides.—The rise of spring tides at point Divi is 5 to 6 feet ; the whole neighbourhood is subject to inundation with on-shore gales. It is high water, full and change, at 8h. 15m.

DIRECTIONS.—Vessels from Nizámpatam bound to the eastward should be guided entirely by the lead, and not approach the coast nearer than $5\frac{1}{2}$ or 6 fathoms by day. Between False Point Divi and point Divi, the water should not be shoaled to less than 8 fathoms. By night, the coast should be approached with great caution, as the bank of soundings extends but a few miles to seaward. Even by day, the lead should be carefully hove when in soundings, as the coast is very low and frequently hidden by haze.

MASULIPATAM, on a branch of the Kistna river, is the chief and northern port of the Kistna district, but of small commercial importance, the greater part of the trade finding its way to Cocanada. The first British factory on the Coromandel coast was erected here in 1622. The town is situated on a low unhealthy plain subject to inundations. In 1800, in May 1843, and in November 1864, Masulipatam was submerged during cyclones, the loss of life in each case being great. In 1891 the population numbered 40,000.

LIGHT.—From Masulipatam fort flagstaff, at an elevation of 69 feet above the sea, is exhibited a *fixed white* light, visible in clear weather at a distance of 6 miles.

Buoys.—Two conical buoys, the northern painted black, the southern one red, are moored in $3\frac{1}{2}$ fathoms at low water, off the mouth of Masulipatam river, to mark the position of boats waiting outside the bar to communicate with vessels approaching the port. Masulipatam flagstaff bears W. $\frac{3}{4}$ S. from the northern buoy, and W. by N. $\frac{1}{4}$ N. from the southern one.

Anchorage.—A good position for large vessels is in about $4\frac{3}{4}$ fathoms at low water, with Masulipatam flagstaff or light W.N.W., and point Divi lighthouse S.W. In the south-west monsoon a vessel may anchor about 2 miles northward of this position, with the flagstaff bearing West. Small craft anchor nearer the shore in 3 fathoms. The roadstead is capacious, and has good holding ground ; but during the north-east monsoon, with a ground swell, communication with the shore will be found tedious and uncertain. The limits of the

port are marked by boundary pillars. Ballast may not be thrown overboard in less than 10 fathoms of water.

Caution.—There is said to be less water than shown on the chart off Masulipatam.

DIRECTIONS.—Bound to Masulipatam from the southward, after making False Point Divi, stand in a north-east direction till abreast of point Divi, keeping in 7 or 8 fathoms until Masulipatam flagstaff bears W.N.W., when steer for the anchorage, keeping the lead going. In rounding point Divi do not come under 8 fathoms till to the northward of it.

In June, July, and August, sailing vessels should endeavour to make point Divi by daylight, and hug the coast as close as prudence will permit, as the westerly winds are frequently very strong during the south-west monsoon, necessitating beating into the anchorage, which will be found tedious owing to the freshets setting a vessel off the land.

During the north-east monsoon, vessels should invariably sight Narsapur point, and then steer for the anchorage.

The river mouth, near which Masulipatam is situated, has a bar; with a beacon on it, which denotes the position of the best channel across the bar for boats. The depth on the bar is about $4\frac{1}{2}$ feet at high water springs; at low water boats can seldom cross. Cargo boats proceed up the river for a distance of about 4 miles to discharge at the jetty in the port, or go on by canal to Bezwada on the main channel of the Kistna river.

Coal.—No coal is kept in stock at Masulipatam, but it can be obtained from Bezwada, 48 miles from Masulipatam, and connected with it by canal, if notice has been given a considerable time beforehand. Coal could only be shipped by local cargo boats.

Communication: Rail, Steam, Telegraph.—The nearest railway station is at Bezwada, 48 miles by road and canal from Masulipatam; the canal is closed annually from March to May inclusive; Bezwada is connected with Madras, Bombay, and Calcutta by railway. The steam vessels of the British India Company keep up weekly communication with Madras and Rangoon. Coasting steamers also ply weekly to Calcutta and Bombay. Masulipatam is connected with the telegraphic system of India.

Trade, Shipping.—The exports are castor seed, paddy turmeric, chillies, and grain; valued in year 1890–91 at Rs. 3,555,000. The imports are glassware, piece goods, twist, metals in manufactured state, cement, Mangalore tiles, iron work for railways or bridge material, and timber logs from Burma; of an aggregate value in year 1890–91 of Rs. 1,500,000.

In the year 1890-91 Masulipatam was visited by 241 British steamers of 355,506 collective tonnage, and 210 native craft of 21,503 collective tonnage. No British sailing vessels or foreign steamers entered the port.

Supplies.—Provisions and water are scarce and difficult to procure. No repairs to machinery or hull can be undertaken.

Hospital.—There is a civil hospital and dispensary at Masulipatam.

STORM SIGNALS are shown at Masulipatam. For details *see* pages 27, 127.

Boat signals.—When communication with the shore is dangerous, owing to the surf on the bar, a red and white chequered flag is hoisted at the flagstaff of the fort. When the surf becomes impassable, a white pendant with a red ball is hoisted under that flag.

If a boat is urgently required during the night, three lights should be hoisted horizontally, and in case of fire or danger, blue lights should be burnt and guns fired.

Climate.—The climate of Masulipatam is hot and dry, nearly all the rain falling in the south-west monsoon between June and October.

Month.	Temperature.					Humidity.		Cloud.	Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Mean.		Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.							
	°	°	°	°	°							
January - -	76	85	68	17	26	72	4.1	1.0	3	29.99	.12	
February - -	77	87	68	19	28	71	2.8	0.3	1	—97	.13	
March - -	81	90	72	18	29	73	2.5	0.4	1	—91	.14	
April - -	85	93	77	16	27	72	2.9	0.6	1	—82	.13	
May - -	87	98	81	17	32	67	3.9	2.2	3	—74	.13	
June - -	88	99	81	18	31	61	6.5	2.1	10	—70	.12	
July - -	86	97	79	18	28	64	7.1	3.8	14	—72	.12	
August - -	84	94	79	15	27	72	6.9	5.6	15	—67	.12	
September - -	83	91	78	13	23	76	6.3	6.5	16	—74	.13	
October - -	81	89	76	13	24	78	5.5	8.8	12	—84	.12	
November - -	77	85	71	14	24	78	5.1	4.0	6	—94	.12	
December - -	74	83	67	16	24	75	4.2	0.7	2	30.00	.12	

THE COAST from Masulipatam trends north-eastward and eastward 36 miles to Narsapur point, forming Masulipatam bay, in which the soundings are regular, and the shores, low and sandy, are safe to approach to a depth of 7 fathoms, by day. The Samúlda, or Samúda river, discharges itself into the bay 25 miles eastward of Masulipatam.

GODÁVARI DISTRICT commences at Samúlda river, about 12 miles westward of Narsapur (Vasishta) mouth of Godáviri river ; it has six British ports or roadsteads—Perupalem, Narsapur, Bandarmalanka, Coringa, Cocanada, and Uppada. Besides these, Yanaon, a small French settlement, stands $5\frac{1}{2}$ miles southward of Coringa, at the point where the Coringa river issues from the Godáviri.

NARSAPUR POINT is low, woody, and marked by an obelisk 80 feet high. It forms the western shore of the river of that name, and bears about N.E. by E., 35 miles from point Divi. The Narsapur river or Vasishta Godáviri, which is a branch of the Godáviri, has only 9 feet water on its bar at high water. Outside, there are soundings of from 2 to 3 fathoms, to a distance of 2 miles southward of the entrance. The channel leading into the river is between two sand banks, on which the sea breaks.

Ships rounding Narsapur point should not come into less than 7 fathoms by day, nor 20 fathoms by night. Formerly, vessels of from 300 to 400 tons were built on Narsapur river ; native craft still resort to this place for repairs ; but the boat-building business is languishing and the population on the decrease.

Narsapur town, population about 6,000, lies 6 miles up the river. Cargoes are mostly discharged at Antravedi near the river mouth. Madapolem, which gives its name to a certain cheap cloth fabric, once joined Narsapur, but erosion of the fore-shore of the river has caused the present town of Narsapur to be built on the opposite bank. Narsapur has a celebrated Hindu shrine, visited once a year during a five days' festival by 20,000 pilgrims.

THE COAST from Narsapur point trends E.N.E. for 14 miles to the mouth of the Bandarmalanka (Vanteyam Godáviri) river (marked by a beacon pole 26 feet high), and is low, but thickly wooded. Two large and conspicuous clumps of casuarina trees are situated, on the eastern bank, near the mouth of the Bandarmalanka. This part may be approached to 10 fathoms by day ; the soundings to seaward, however, deepen suddenly to 50 and 100 fathoms about 9 miles off-shore.

From the entrance of the Bandarmalanka river, which is called Warreo, off which a shoal spit forms after freshets, the coast takes the direction of N.E. by E. $\frac{3}{4}$ E. for 22 miles, to Kotapalem beacon, a pole 26 feet high, which marks the south side of Vrudha Gautami river. This river is a very direct arm of Godávári river, and the discharge of water from it is said to be increasing.

The strong current has cut a channel, 5 to 10 fathoms in depth, through the alluvial soil, and the river is joined near its mouth by two feeders, which together make an ebb stream running at the rate of 4 knots in the wet season. As the stream issues it is met by the swell always running on this coast, and two spits have formed in a seaward direction, the southern one called the Sacramento spit.

SACRAMENTO SHOAL, on which the U.S. vessel-of-war *Sacramento* was lost in June 1867, consists of hard sand, and is the extreme detached portion of the southern of the two spits just mentioned. From its outer edge, which is 2 miles from the line of coast, Hope island lighthouse bears North, $13\frac{1}{2}$ miles. There are depths of 6 fathoms 4 cables outside it, and the 10 fathoms-line is about 2 miles to the eastward. The shoal nearly dries, and the sea always breaks on it, except at its outer edge. Thirthalmundi village, with an obelisk among the huts, near the shore about $5\frac{1}{2}$ miles northward of Sacramento shoal, bearing N. by W., leads one mile seaward of the shoal.*

Anchorage.—The northern of the two spits forms a good break-water, northward of which there is anchorage in 4 fathoms, mud, nearly one mile offshore; with shelter from winds between S.S.E., through west, and N.N.W. In rounding the spits off the river mouth, their ends should be given a berth of one mile.

Vrudha Gautami river.—Directions.—In 1891 a single tree stood at the actual mouth of the river. The least water in the channel over the bar is 9 feet at low water springs. Small vessels can enter in fine weather, sailing vessels requiring a fair wind. Steer a mid-channel course, S.W. $\frac{1}{2}$ W. over the bar, between the two lines of breakers, and when within Sacramento shoal, keep north-westward towards the single tree, following the line of the northern spit at 2 cables distance until into the river. Inside the bar the water soon deepens to 4 and 6 fathoms.

* The outer edge of this shoal had not altered between 1889 and 1891.

THE COAST between Kotapalem and Godávári point, about 21 miles to the northward, is very low. In this vicinity distances judged by eye are likely to be erroneous, owing to the sand haze. Bahiraswami temple is $4\frac{1}{2}$ miles northward of Kotapalem; and 2 miles further northward is Thirthalmundi village, situated on a mound, and rendered conspicuous by a white obelisk, 32 feet high, on the beach, and the village near. There are several sandhills between the mouth of the Vrudhá Gautami and Thirthalmundi, but none northward of that village. A small break in the coast occurs $2\frac{1}{2}$ miles northward of Thirthalmundi.

Tides.—It is high water, full and change, at Sacramento shoal at about 9h. 15m. At neaps the tide is about half an hour earlier than at Cocanada.

HOPE ISLAND, in lat. $16^{\circ} 50'$ N., is low, swampy, covered with jungle, and only 3 feet above the sea; consequently it is submerged during high tides. It is one of a broken chain of similar islands, formed by the alluvial deposit brought down by the Godávári river, at the mouth of which it is situated.

LIGHT.—On the south part of Hope island, about $2\frac{1}{4}$ miles from the sea, is a column 94 feet in height, coloured in alternate horizontal bands, black and white, from which is exhibited at an elevation of 83 feet above the sea a *fixed white* light, visible in clear weather between the bearings of N. 20° E., through west, and S. 20° W., from a distance of 14 miles.*

Godávári point, often termed Gordeware, extended, in 1891, 8 miles N. by E. $\frac{1}{4}$ E. from Hope island lighthouse. It is low, sandy, and covered in places with small scrub; and the sea breaks heavily on it during the south-west monsoon. Its northern extremity dries soon after half ebb; and on its western side, is the entrance to the Godávári, also known to mariners as the Gordeware river.

A tripod beacon, surmounted by a pole with basket, 28 feet high, is placed upon the dry sandy point of Godávári, about 3 miles southward of the northern extremity of the point, and $4\frac{1}{16}$ miles N. 29° E. from Hope island lighthouse.

* Hope island lighthouse is often obscured by the mist rising from the low jungly ground. The locality swarms with insects, and myriads of these hover about the lantern, particularly during a calm night, and obscure the light. Great caution should therefore be exercised in approaching this coast during the night.

A red buoy, with pole and basket, is placed in 7 fathoms, with Hope island lighthouse bearing S. by W. $\frac{1}{2}$ W., and Vakalapudi lighthouse N.W. by W. $\frac{1}{2}$ W., or about $1\frac{1}{10}$ miles N.E. by N. from the extremity of Godávári point. The position of this buoy cannot always be depended upon.

Soundings.—Between Sacramento shoal and Godávári point the soundings are regular; the 10-fathom line being $1\frac{3}{4}$ miles from the outer edge of Sacramento shoal, $2\frac{1}{2}$ miles from the coast off Thirthalmundi, and 2 miles outside Godávári point.

For description and directions for Cocanada and Coringa bay, *see* next chapter.

CHAPTER IV.

ORISSA COAST.—COCANADA TO FALSE POINT AND
DHAMRA RIVER.

 VARIATION 2° TO 3° E. IN 1892.

COCANADA,* situated in the bight of Coringa bay, in latitude 16° 56½' N., about 7 miles westward of Godávári (Gordeware) point, stands on the banks of a small river, which is connected with the Godávári river by a canal 32 miles in length, at a town called Dowlaishvaram, and is considered the principal seaport of the Godávári district, as well as the safest natural port on the east coast of Hindustán. Two small piers run out from the mouth of the Cocanada river, and by careful dredging a channel of sufficient depth is preserved to enable cargo boats to communicate with the shipping at all times of tide. On the north bank of the river, and nearly half a mile from the coast, is the tower of the old lighthouse, 80 feet high and painted black. The port officer's flagstaff is nearly half a mile westward of the tower. The limits of the port are defined on-shore by boundary pillars, and extend seaward to 13 fathoms water. No ballast is permitted to be thrown overboard in a less depth than 12 fathoms.

CORINGA (COCANADA) BAY is shallow, with extensive mud flats, which dry at low water, extending off the mouths of the Godávári river. The bay has been silting up for many years, owing to the gradual advance of the shoals formed by the deposit brought down by the Godávári river. The effect of this process has been to shift the anchorage further to the north-east, but without in any way diminishing its safety. Like Masulipatam, the shores of Coringa bay are liable to periodical inundations during cyclones. In 1706, 1787, and in 1839, Coringa, a town situated about 7½ miles south of Cocanada, was completely inundated, the water rising above the roofs of the houses.

LIGHT.—At Vakalapudi, 500 yards from the coast on the west side of Coringa bay and nearly 5 miles northward of the entrance to

* See Plan of Cocanada or Coringa bay showing the mouth of the Godávári river. scale, $m = 0.7$ inches, on Admiralty chart, No. 71a.

Cocanada river, is a white column, 76 feet high, from which at an elevation of 80 feet above high water is exhibited a *flashing white* light, showing a flash *every twenty seconds*, visible in clear weather 14 miles. This light is shown principally to enable vessels to avoid Godávári point.

Signal Station.—This lighthouse is in telephonic communication with the Port office, Cocanada, and is the signal station of Coringa bay.

Harbour lights.—On the groynes at the entrance of the Cocanada river, are exhibited, at an elevation of 10 feet above the sea, two *fixed red* lights, visible in clear weather from a distance of about 2 miles. These lights are shown as guides to boats entering or leaving the river.

Anchorage off Cocanada, with Vakalapudi lighthouse bearing N.W., and the old lighthouse between S.W. by S. and S.W. by W., is safe, with a soft bottom, but good holding ground. Vessels lie here at all seasons, and although the anchorage is about 4 miles from the mouth of the Cocanada river, yet owing to the waters of the bay being generally smooth, and the navigation easy, communication with the shipping and the shore is never impeded. There is also anchorage in 5 fathoms, one mile off shore, with Vakalapudi lighthouse N.W. by W. $\frac{1}{2}$ W. Although exposed to winds from north-north-east to east-south-east, and in a gale offering a lee shore, vessels never put to sea from here on the approach of bad weather, and in the event of a vessel being driven from her anchors, which seldom occurs, the soft muddy bottom proves security against any serious damage.

GODÁVARI RIVER, which rises about 70 miles north-east of Bombay, within 50 miles of the west coast of Hindustán, traverses the whole breadth of the peninsula in an easterly direction, is said to be 900 miles in length, with a breadth in parts during the rainy season of $1\frac{1}{2}$ miles, and discharges itself by its northern and principal mouth about 7 miles south-east of Cocanada.

The entrance of the main channel into the Godávári river, which in 1882, was not more than a cable wide, was then about $2\frac{1}{2}$ miles northward of Godávári point, and had a depth of 7 or 8 feet at low water on the bar, deepening to 13 and 14 feet inside, and to 20 and 30 feet in the narrow channel between Grass point and Hope island. There are heavy breakers on the bar at almost all times. Lanes are cut through the jungle from the west shore of the channel near Hope

island towards the town of Coringa to the westward. The entrance to the Coringa river, which is very shallow, is about 2 miles south-east of the entrance of the Cocanada river, and a road connects the town of Coringa with that of Cocanada.

CORINGA is now considered a closed port, the channel through the flats leading to the river having only from one to 2 feet at low water Indian springs. Small vessels are built at Coringa—spars can be purchased, and carpenters obtained. At about 6 miles above Coringa is the French settlement of Yanaon or Yanam.

DIRECTIONS.—By day, sailing vessels from the southward bound to Cocanada in the south-west monsoon should fall in with the land near Bandarmalanka, in about latitude $16^{\circ} 30' N.$, and coast along to the northward, in not less than 10 fathoms. Great care is necessary between Bandarmalanka and Godávári point to avoid Sacramento shoal, described at page 140. The beacon near Godávári point, 28 feet in height, and the red buoy to the northward, may be seen, but that point should not be approached nearer than in 10 fathoms, until Vakalapudi lighthouse bears westward of W.N.W., when the anchorage may be steered for, and a berth taken up in about 5 to 6 fathoms.

When working into the anchorage in the south-west monsoon sailing vessels should not stand further to the south-west than 6 fathoms at low water. The lead should be kept constantly going, as the water shoals very rapidly when standing into Coringa bay, and the lead will be found the best guide.

During the north-east monsoon, sailing vessels should make the land off Pentakota, about 30 miles northward of Cocanada, and then steer along the coast to the southward in 12 fathoms. In the absence of observations, and doubt existing as to whether a vessel is to the north or south of Cocanada, it will be found that if a vessel be to the northward, the land will appear bold, with the range of hills extending away to the north-east as far as the eye can see; if to the southward, the coast will be low and sandy, interspersed with a few sandy hillocks, palmyra trees or low jungle.

At night, approaching from the southward great care is necessary, the lead should be kept going, and a vessel should not close the shore nearer than in 12 fathoms. It would be prudent to anchor in about 10 fathoms until daylight, and then run in and select a convenient berth.

From the northward, during the north-east monsoon, the anchorage should be approached with Vakalapudi light bearing W.S.W., and when in 8 fathoms, anchor.

Current.—From about August to November the current runs to the south-west. From about the middle of December until July the current runs to the north-eastward in the approach to Coringa bay. It is particularly strong in March and April, when its rate is sometimes 4 knots an hour, at 10 miles offshore, and its direction rather inclined towards the shore northward of Coringa bay. In July and August its rate is less than one knot. This current also prevails to the north-eastward up to False point, but is not so strong as off Coringa bay.

Tides.—It is high water full and change at Cocanada at 9h. 1m. springs rise $5\frac{1}{4}$ feet and neaps $3\frac{1}{4}$ feet; neaps range $1\frac{3}{4}$ feet. The ebb stream sets to the north-east, flood to the south-west. The spring flood tides are strong in this locality, especially from October to February, and must be taken into account when closing the land near point Godáviri and Cocanada. The tides are irregular, and greatly influenced by the wind and the freshets out of the Godáviri river.

The tides are subject also to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by at times as much as one foot.

At the anchorage there is very little tidal stream; it is usually slack during the flood tide, and sets north-eastward during the ebb.

STORM SIGNALS are shown from Vakalapudi lighthouse. For details of signals *see* pages 27, 127.

Supplies.—Fresh provisions are plentiful and cheap. Water can be supplied alongside in iron tanks. Marine stores or salt provisions must be obtained by steamer from Madras or Calcutta. No repairs can be executed to hull or machinery.

Coal.—About 500 tons of country coal are kept in stock. Steamers are coaled at the roadstead from boats, each carrying about 20 tons.

Communication.—Cocanada is connected with the telegraphic system of India. There is communication by steamer with other ports. A railway to connect with the general Indian system is in course of construction.

Trade.—Shipping.—The exports are gingelly and castor seeds, aggeri, tobacco, hides, and oils, of a total value in 1890 of Rs. 13,878,848. The imports are piece goods, metals, and spirits, of

a total value in 1890 of Rs. 3,396,671. In 1890 Cocanada was visited by 444 vessels of 527,366 aggregate tonnage.

Hospital.—A seamen's hospital is attached to the dispensary.

Population of Cocanada in 1891 was 40,000.

The COAST from Cocanada trends N.E. $\frac{1}{2}$ N. and is low for about 15 miles, with numerous villages and cocoanut trees. Low sand hills then commence and continue to Pentakota, a further distance of 15 miles. At $5\frac{1}{2}$ miles north-eastward from Vakalapudi lighthouse is Uppada house, a minor port for native craft only.

At Wantimaudi, 9 miles south-west of Pentakota, there is a masonry beacon on a sandhill close to the coast; but this beacon is not easily seen.

The 10 fathom line is about 3 miles from this coast.

Round hill, 26 miles northward of Cocanada, is 2,143 feet high, and in clear weather shows prominently when seen from near Cocanada.

Pentakota, 30 miles north-eastward from Cococanda, is situated in the south part of Vizagapatam district, at the mouth of a river in lat. $17^{\circ} 18\frac{1}{2}'$ N. The entrance to the river may be known by two sand hills of moderate height, and a cocoanut grove close to them. Bearing N. by W. $\frac{1}{4}$ W. from the mouth of Pentakota river, distant 8 miles, is Tuni hill, of conical shape, 1,102 feet in height, and a good landmark for making the place. Pentakota has a post office and custom house, but is now never visited by shipping.

A heavy sea rolls in here during the south-west monsoon, at which season the river is closed; during the north-east monsoon the river is open.

Sudikonda is a very remarkable cone-shaped hill, 523 feet high, and about 2 miles north of Pentakota. Although not the highest hill in the vicinity, it is the most conspicuous, owing to its form and colour; and shows well from seaward when bearing northward of W. by N.

COAST.—The feature of the coast, between Pentakota and Vizagapatam, is a succession of rounded hills, conspicuous at night, showing up well in contrast with the low sandy plain on which they stand.

Dongalkonda is a conspicuous white obelisk, on smooth rising ground, half a mile from the coast, and 4 miles north-eastward of Pentakota. Polarem, a small but very conspicuous rocky eminence,

on the beach in lat. $17^{\circ} 23\frac{1}{2}$ N., is 72 feet high, and surmounted by a beacon 15 feet in height.

Wattara,* or Ratada, in lat. $17^{\circ} 26'$ N. or 17 miles north-eastward of Pentakota, is situated on a table land 673 feet high at the south point of entrance to a small bight, formed at the mouth of three small rivers. The river mouth is almost entirely blocked at low water.

Rambhid Quoin is a remarkable round hill, 606 feet high, surmounted by a beacon 16 feet in height. It is situated 4 miles north-eastward of Wattara, and presents a steep face to seaward.

Sanjib peak, a cone-shaped hill, with a somewhat flattened and broken summit, is 2,139 feet high, and situated N. by E. $\frac{1}{2}$ E. 14 miles from Pentakota.

Pudimadaka, or Pudi, situated 8 miles north-eastward of Wattara, is a small village, the locality of which may be recognised by Pillar rock, a remarkable rocky islet bearing S.E. by S. from the village and half a mile from the shore. This rock, and some dark cliffs on the coast near it, show conspicuously against the white sandy beach. Pillar rock has about 5 fathoms near it, and a ledge of rocks, which serve as a breakwater during the south-west monsoon, lies between it and the coast, so that vessels at that season are enabled to load with facility, and carry on communication with the shore. A small export trade is carried on from Pudimadaka.

The 10 fathom line is only three-quarters of a mile outside Pillar rock.

Anchorage may be obtained in 6 fathoms with Pillar rock bearing about S.W. by S., and the godowns on the beach W. by N., during the south-west monsoon; but, during the north-east monsoon, vessels should anchor further from the shore, in 7 or 8 fathoms, so as to give Pillar rock a wide berth in case of being compelled to put to sea.

The COAST from Pudimadaka trends about N.E. by E., and curves outward slightly, for about 21 miles to Vizagapatam; it is broken and rocky, but no dangers extend more than 3 cables from it, and the 20 fathom line is generally 2 miles from the beach.

* The coast of Orissa, or Orixia, is said to commence to the south of Wattara, extending from thence to the entrance of the river Hugli, but the south part of this coast has been generally called the Northern Circars, and the name Orissa applied to that part north of Kalingapatam.

The coast is backed by a plain studded with small hills, some of which near the coast, have the sand drifted so high on their western sides as to render them conspicuous.

Double Quoin rock, about 4 miles north-eastward of Pillar rock, answers to its name. Viewed from the northward, it appears a low black double rock on the sandy beach. The coast immediately north and south of it is sandy, with a few scattered rocks along the beach.

Kutkonda (Bluff Hummock) is a small conspicuous rocky promontory, 10 miles south-westward of Vizagapatam; it is 145 feet high, and surmounted by a beacon 16 feet in height.

Pigeon islet is small, rocky, 82 feet high, and lies half a mile offshore in a small bay $4\frac{1}{2}$ miles south-west of Vizagapatam.

VIZAGAPATAM* may be recognised from seaward by Yarada hill, 1,174 feet high, which slopes gradually towards the coast and terminates abruptly in the sea to the eastward, in Dolphin's Nose, a bluff headland, with a masonry tower and flagstaff on its summit, and several houses on its north side.

Adjoining Vizagapatam, about $2\frac{1}{2}$ miles to the northward, is Waltair, formerly a military station, and still the head quarters of the district, where most of the Europeans reside. This place has sometimes been mistaken, by strangers, for Vizagapatam.

The town of Vizagapatam, the chief of the district of the same name, is advantageously situated on a level amphitheatre formed by two parallel ranges of hills. Of late years the town has increased considerably, and contained, in 1881, 30,291 inhabitants, many of whom are Muhammedans.

The limits of the port are defined by boundary pillars. There is a dispensary in the town where Lascars may be treated.

Buoy.—An iron buoy, painted red, for a vessel's stern moorings, is moored in a depth of about 5 fathoms, about 4 cables eastward of old Dutch fort.

Anchorage.—The best is in from 5 to 7 fathoms, sand, with the fort flagstaff bearing W. by N. $\frac{3}{4}$ N., the mosque on a hill near the river entrance W. $\frac{1}{2}$ N., and the flagstaff on Dolphin's Nose S.W. $\frac{1}{4}$ S. In this position the river will appear open, and the eastern extremity of Dolphin's Nose will have shut in the land to the southward of it. Care should be taken in anchoring, as the soundings shoal quickly,

* See Admiralty plan of Vizagapatam, No. 239; scale, $m = 1.95$ inches.

and a large vessel anchoring in 6 fathoms, swinging towards the shore, may find her stern in $4\frac{1}{2}$ fathoms at low water. The bottom inside the 3-fathom line northward of the town is foul, and vessels should therefore not venture too close in.

DIRECTIONS.—Dolphin's Nose, though a remarkable headland when approached from the north, or south, or coastwise, is not easily seen under the high land beyond it, when viewed from a distance seaward. In making Vizagapatam during the north-east monsoon, endeavour to sight a conspicuous hill known as the Sugarloaf, situated midway between Vizagapatam and Bimlipatam, and about 5 miles north-eastward of Waltair. Coming from the southward, Pigeon island, about 7 miles south-westward of Vizagapatam and close to the shore, will be sighted inside the bight formed between Dolphin's Nose and the first high land to the southward of it.

Maonderu river drains the high land on which Vizagapatam is situated and discharges itself into the small bight immediately north of Dolphin's Nose. Harbour works are in progress for improving the entrance; at present (1891) vessels of 12 feet draught can enter at high water springs, and of 9 feet draught at high water neaps. Mud docks for native craft are situated about a mile up the river. The bar, which has 5 feet over it at low-water spring tides, is dangerous, and can only be crossed in ships' boats in fine weather and during southerly winds.

Communication. — There is weekly communication with Calcutta, Madras and coast ports, by steamers of the British India Company. Vizagapatam is connected with the telegraphic system of India.

Supplies are plentiful, but no repairs to hull or machinery of vessels can be executed.

Trade.—Shipping.—The exports are jaggery, hides, turmeric and myrabolams; valued in 1890 at Rs. 1,461,799. The imports are European stores and railway material; valued in 1890 at Rs. 665,977.

In 1890 the port was visited by 237 vessels of 325,822 aggregate tonnage.

Tides.—It is high water, full and change, at Vizagapatam, at 9h. 3m., springs rise 5 feet, and neaps 3 feet; neaps range one foot. In common with other places on this coast the tides are subject to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by, at times, one foot.

Winds.—From March to June, the prevailing winds are south-west; in July and August north-west; in September westerly, and from October to December north-east. In the latter months, the north-east winds are fresh during the day, with light westerly wind at night. Heavy squalls with rain may be expected in October and November.

STORM SIGNALS are shown at Vizagapatam. For details of signals *see* pages 27, 127.

Waltair Point is a low sandy point about $2\frac{1}{2}$ miles north-east of Vizagapatam, with a rocky foreshore, and red sandhills which are at times conspicuous from the offing. The bottom, out to a depth of 8 fathoms, is foul, and vessels should not anchor near Waltair point. On the point is a house in ruins, with a grove of palm trees behind it. The north boundary of the port of Vizagapatam extends to close southward of the ruin.

The COAST from Waltair point trends about N.E. by N. 12 miles to Bimlipatam, situated on the south point of entrance to a small river. About midway between Waltair point and Bimlipatam and near the coast is Rusi (Sugarloaf), a round-topped hill, 490 feet high, forming a conspicuous landmark. The high land terminates about 5 miles south of Bimlipatam, the intervening gap having isolated conical hills.

Upada bluffs, 2 miles north-eastward of Rusi, have the appearance of flat table lands about 400 feet high, with a steep face to seaward. Shoal water extends nearly half a mile offshore in their vicinity.

A large sandhill, 314 feet high, and $1\frac{1}{2}$ miles S.W. of the summit of Bimlipatam hill, is a good landmark.

BIMLIPATAM* is a town of considerable importance in latitude $17^{\circ} 53\frac{1}{2}'$ N. By day it may be recognised by a detached hill near the coast, on the north-eastern slope of which it is built. This hill, 531 feet high, is surmounted by a few scraggy trees and a pyramidal obelisk, 16 feet high. On its eastern slope, about half way up, is a temple, very conspicuous when the sun shines on it in the afternoon. Northward of the town is a large shallow backwater, the entrance to which, a quarter of a mile north of the town, is almost dry at low water.

* *See* Admiralty chart, Bimlipatam to Gopalpur, No. 1424; scale, $m = \cdot 25$ of an inch. The description of the coast between Bimlipatam and Gopalpur is from remarks by Commander R. F. Hoskyn, R. N., in charge of the Indian Marine Survey, 1890.

Approaching from the northward Amnam hill, smooth, flat-topped and bare, 833 feet high and $3\frac{1}{4}$ miles northward of the town, is a good mark. Vessels from the southward and close inshore may not sight Bimlipatam until within 6 or 7 miles of the port, as Upada bluffs intervene.

Anchorage.—The bottom off Bimlipatam of sand and mud, affords good holding ground, and the roadstead is smoother than at adjacent ports along the coast. In the south-west monsoon the best anchorage is in 6 to 7 fathoms with the flagstaff bearing W. $\frac{1}{2}$ S. In the north-east monsoon, anchor in the same depth, with the flagstaff from W. by S. to W.S.W. In both positions at a distance of nearly one mile from the coast.

The landing place is on the beach between the entrance to the backwater, and the pier in front of the port office.

Tides.—It is high water, full and change, at 8h. 53m.; springs rise $5\frac{1}{4}$ feet, neaps $3\frac{1}{3}$ feet, and neaps range $1\frac{2}{3}$ feet. In the roadstead there is hardly any perceptible tidal stream.

Supplies of fresh meat and live stock can be obtained, and native vegetables in season.

Trade.—The imports are principally European manufactured goods and jute. The exports, gingelly, niger, indigo, myrabolams, hides, horns, jaggery and gunny bags. At Chitávalasa, about $2\frac{1}{2}$ miles N.N.E. of Bimlipatam, there is a large gunny bag manufactory, with a conspicuous chimney. Large quantities of salt are also made. In the year 1888–89 the imports were valued at Rs. 1,956,930, and the exports at Rs. 3,454,439.

Shipping.—In 1888–89 the aggregate tonnage of the 274 vessels which visited the port was 379,356 tons; of which, 244 were steamers of 375,469 tons; 2 sailing vessels of 2,019 tons; and 28 native craft of 1868 tons.

Repairs.—Small repairs to shipping can be executed.

Hospital.—There is a hospital at Bimlipatam to which Europeans are admitted.

Communication.—There is a post and telegraph office in the town. British India Company steamers call weekly; and those of the Asiatic Company fortnightly, on the voyage up the coast to Calcutta.

Communication with the shore through the surf in ship's boats is prohibited; Masula boats can be hired at 2rs. 4a. per trip for passenger boats, and 1r. 8a. for cargo boats. On Sundays and

holidays, and after 5h. 30m. p.m. on ordinary days, the above rates are doubled.

STORM SIGNALS are shown at Bimlipatam. For details of signals, *see* pages 27, 127.

Konáda, a town with a population of about 5,000, is situated about 10 miles north-eastward of Bimlipatam, near the mouth of a small river, which may be recognised by several white buildings and some cocoanut trees on the low ground on its north side ; whereas the southern side rises in bare sandhills, which join the rising ground extending to Amnam hill. Konáda has a large salt factory, also a police and a post office ; but its trade is now absorbed by Bimlipatam.

Anchorage may be obtained anywhere off the mouth of the river in 5 to 6 fathoms, sand bottom.

THE COAST between Bimlipatam and Konáda is sandy, and broken about midway by some red cliffs 20 to 40 feet high, conspicuous from seaward in the forenoon when the sun shines on them. Between these cliffs and Konáda the beach is fronted by rocks extending a very short distance seaward. Beyond Konáda the coast trends about N.E. by E., 36 miles, to Kalingapatam ; throughout its whole extent it is a sandy beach, backed by sandhills from 40 to 60 feet high, and broken only by the mouth of the Languliya river, 25 miles from Konáda. Between Konáda and this river the hills in many places approach the coast ; but between the river and Kalingapatam there is an extensive plain, which is dotted here and there with isolated hills. The best marks from seaward are the following :—

Kandívalasa (Santapilli) peak, about 7 miles northward of Konáda, is 1,761 feet high, and the loftiest and most prominent peak in this neighbourhood. It presents a nearly conical appearance on all bearings from seaward, and is an excellent landmark.

SANTAPILLI LIGHT.—From a low white tower 31 feet high, on a hill three-quarters of a mile inland, north-west of Santapilli rocks, or in about lat. $18^{\circ} 4' N.$, is displayed a *fixed white* light, at an elevation of 163 feet above high water, visible in clear weather from a distance of 14 miles.

Salihundam (Gara hill), $5\frac{3}{4}$ miles W. $\frac{3}{4}$ N. of Kalingapatam lighthouse, is a conspicuous, bare, wedge-shaped hill, 407 feet high, trending to the eastward, and a very good landmark when making Kalingapatam.

Santapilli rocks lie S.E. $\frac{3}{4}$ E. $6\frac{1}{4}$ miles from Santapilli lighthouse and $5\frac{1}{2}$ miles from the coast. They extend 4 cables N.N.E. and S.S.W., and are less than 2 cables in width, with a least depth of 8 feet, and steep-to on all sides, having 9 to 10 fathoms close around. In fine weather the sea does not break on these rocks, nor is there any discoloured appearance over them; but with a moderate swell the breakers on them may be seen from a distance of 4 or 5 miles.

CAUTION.—Santapilli rocks, being in the track of coast navigation, great care should be taken to avoid them. Santapilli lighthouse, in line with Kandivalasa peak, N.W. $\frac{1}{2}$ N., leads $1\frac{1}{4}$ miles southward of the rocks; and, the summit of an isolated, bare, red, double-peaked hill, $1\frac{1}{2}$ miles N.N.E. of Santapilli lighthouse, and 384 feet high, in line with Kandivalasa peak, N.W. by W. $\frac{1}{8}$ W., leads 2 miles northward of them. The channel inside the Santapilli rocks may be easily navigated during daylight. At night safety depends on the bearing of Santapilli light and strict attention to the lead.

Agra rock, on which the steam-vessel *Agra* was lost in 1887, is a rocky patch, with a depth of $3\frac{1}{4}$ fathoms on it at low water; it lies $8\frac{1}{2}$ miles N.E. by E. $\frac{3}{4}$ E. from Santapilli lighthouse, and 9 cables from the coast. The sea is not discoloured over this rock, and rarely breaks on it. Kandivalasa peak, open southward of Rámachandrapur W.N.W., leads more than half-a-mile southward of Agra rock. Rámachandrapur is a flat-topped hill, 5 miles north-eastward of Santapilli lighthouse, and one mile inland; it is 538 feet high, and surmounted by a beacon, 15 feet high.

Currents.—The currents in this vicinity depend principally on the prevailing wind, and run parallel to the coast. Between Santapilli rocks and the coast a greater speed than one knot was not observed.

LANGULIYA RIVER,* forming the boundary between the districts of Vizagapatam and Ganjám, discharges into the sea about 19 miles north-eastward of Santapilli lighthouse, and though broad, it is a shallow stream, filled with granite boulders, and navigable only by native vessels of light draught. Upon the east bank of this river, distant 5 miles from the sea, is the town of Chicacole, a military station, and the chief civil station in the Ganjám district.

KALINGAPATAM (Calingapatam),† the southern port of the Ganjám district, situated on the south bank of the Vamsadhára river, about 12 miles north-eastward of the mouth of the Languliya river, is a small town composed of five villages, the trading community of

* See Admiralty chart, No. 829, Cocanada to Bassein river.

† See Admiralty plan of Kalingapatam, No. 239; scale, $m = 1.95$ inches.

which is almost entirely native. The country in the vicinity is low and flat. Salihundam hill (described above), on the slope of which are two white temples and a tree, is a good landmark. At about 4 miles N.E. by N. of Salihundam hill, a low jagged rocky ridge of hills commences. The lighthouse forms the southern boundary mark of the port; that to the north being indicated by a pillar at the south end of Ampalam village.

LIGHT.—On Sandy point, $1\frac{1}{2}$ miles southward of Kalingapatam, from a white stone obelisk, 70 feet high, with a spiral ladder outside, is exhibited, at an elevation of 76 feet above high water, a *fixed red* light, visible seaward from N.E. to S.W., and seen in clear weather from a distance of 12 miles.

Satara reef of rocks, having 21 feet over the shoalest or northern part, is situated about 6 cables from the shore, with Kalingapatam lighthouse S.W. $\frac{1}{2}$ W., 8 cables, and the flagstaff N.W. $\frac{1}{4}$ N. The reef is steep-to on its north and east sides, having a depth of 7 fathoms, mud, within half a cable.

Anchorage.—During the south-west monsoon vessels should anchor in 5 fathoms with the port flagstaff bearing W.N.W., and the lighthouse S.S.W. In the north-east monsoon the best position for shipping operations may be found with the port flagstaff bearing W. $\frac{1}{2}$ N., and the lighthouse S.S.W. $\frac{1}{4}$ W., in 5 fathoms.

Vamsadhāra river, on which Kalingapatam is situated, is closed to all traffic, native craft having abandoned it, owing to the entrance being blocked with sand banks.

Trade.—Exports consist of rice, gingelly, rape and niger seeds, myrabolams, jaggery, raw hides, buffalo horns, cereals and curry condiments; but of late years the custom returns show a falling off.

Communication.—Steam-vessels of the British India Company call once a fortnight.

Supplies.—Fresh provisions can be obtained, but have to be brought from Chicacole, $17\frac{1}{2}$ miles distant, two days' notice being necessary. Fresh water found here cannot be recommended.

THE COAST, between Kalingapatam and Bavanapadu, 20 miles north-eastward, is straight and sandy, backed for the first 10 miles by numerous small isolated hills, which rise gradually in height, as their distance from the coast increases. The country round Bavanapadu is low and flat.

Bavanapadu is in lat. $18^{\circ} 34' N.$; here a slight change in the general direction of the coast forms a small point, off which rocks

extend about one cable. On the beach one mile northward of the point there is a high circular beacon, striped black and white horizontally. Between the beacon and the point a small river falls into the sea ; its entrance is shallow and entirely blocked at low water.

Pundi.—At 8 miles north-eastward of Bavanapadu is a small rocky point, one mile northward of which, at the mouth of a small river, Pundi is situated. The town is not visible from the sea, but it may be recognised by a high white obelisk, with its summit 60 feet above the sea, and a flagstaff, which are close together on the north side of the river ; also by the flat range of the Bendi hills, 576 feet high and 3 miles inland. The small red hill, Khirsinga, 169 feet high, is on the beach $1\frac{1}{2}$ miles northward of the obelisk.

Anchorage off Pundi, in 7 to 8 fathoms, sand, may be obtained with the obelisk W. by N., from one-half to three-quarters of a mile off-shore. The river has about 6 feet water on the bar at high water springs, and in very fine weather native vessels up to 70 tons enter and anchor off the village.

Trade.—In 1888-89, ten native vessels, with an aggregate of 874 tons, visited the port. The imports, consisting chiefly of rice, castor, seeds and piece goods, were valued at Rs. 21,524 ; and the exports, cashewnuts, cocoanuts, mats and coir, at Rs. 6,710.

Communication.—There is a post office in the village ; a good branch road connects Pundi with the trunk road near Bendi hills, 3 miles inland.

Supplies can only be obtained in very small quantities, but fish is abundant and cheap. There is no fixed tariff for boats, and the natives prefer to use theirs for fishing rather than for cargo. Ships' boats can enter the river with safety at high water, when the swell is moderate.

THE COAST, between Pundi and Baruva, 15 miles north-eastward, is sandy, and, except in the neighbourhood of Baruva, rises gradually and is fairly well wooded.

Rati beacon, in lat. $18^{\circ} 46\frac{3}{4}'$ N., and 8 miles north-eastward of Pundi, is an obelisk, 14 feet high, situated on a small double peaked hill, 342 feet high, at the end of a small range of about the same height running down to the coast. This range is very prominent from the north-eastward or south-westward, and at a distance of 4 or 5 miles has the appearance of a headland. A rocky patch, with $6\frac{1}{2}$ fathoms on it, and 9 to 10 fathoms around, lies 3 miles E.N.E. from Rati beacon, and $1\frac{1}{4}$ miles from the coast.

Baruva (Barwa), a town of some importance, is situated on the north bank of a small river, in lat $18^{\circ} 52'$ N. The surrounding country being level, and the coast fringed with cocoanut trees, buildings are not conspicuous, the custom house and a few native houses only being visible from seaward; but the flagstaff and two high beacons mark the position of the town. These beacons are about 70 yards apart, one is painted white, the other black and white in horizontal bands.

Approaching from the southward, Rati is a very good landmark; and also serves in clear weather, when making Baruva from the northward. About 5 miles northward of the town and 3 miles inland, there is a small range of bare hills, which are nearly 600 feet in height. The precipitous range of Mahendragiri, about 5,000 feet high, rises 14 miles from Baruva.

Anchorage.—The best anchorage off Baruva is in a depth of 6 to 8 fathoms, sandy bottom, at a distance of half to one mile from the shore.

Tides.—It is high water, full and change, at 9h. 5m. (approximate). Springs rise $6\frac{1}{2}$ feet, neaps $4\frac{1}{2}$ feet, and neaps range 2 feet. There is no perceptible tidal stream in the roadstead.

Trade.—In 1888-89 the port was visited by 35 steamers and 2 native craft, of 54,779 aggregate tons. The exports, valued at Rs. 32,717, were chiefly mats, coir rope and cocoa-nuts. The imports, valued at Rs. 14,824, were grain, piece-goods and tobacco. There is a large native passenger traffic with Rangoon.

Supplies.—Good water can be obtained, and fresh provisions in abundance.

Communication.—There is a post and telegraph office at Baruva. A branch road connects the town with the trunk road about $2\frac{1}{2}$ miles inland. Masula boats are always available at one rupee per trip; flag B of the International Code is the signal for a boat. The natives assert that landing can always be effected except in the heaviest weather, and that often when it is dangerous to land at Gopalpur there is no danger at Baruva.

THE COAST, between Baruva and Gopalpur, 28 miles to the north-eastward, is nearly straight and of the same sandy nature as that to the southward; it is backed by level country, except in the neighbourhood of Kowita, 10 miles north-eastward of Baruva, where the ground rises gradually from the coast to a height of about 300 feet, forming a wooded tableland, which is connected with the lower ranges of hills farther back. There is a beacon and high

tree on Kowita tableland. The higher ranges are so frequently invisible as to be of little use to the mariner. Of the hills near the coast the most prominent are :—Ichápur, 6 miles W. $\frac{3}{4}$ S. of Sonapur, a sharp cone, 514 feet high, surrounded by some smaller hills, which are elevated nearly 400 feet; and Dandrásí, 676 feet high, and $4\frac{1}{2}$ miles N.W. by N. of Sonapur. From the eastward, Dandrásí is a round-topped hill, but from the southward it has a long double summit, the western being slightly the higher.

Investigator rock is the only danger off this part of the coast; it lies off Kowita, at 8 cables from the coast, in lat. $18^{\circ} 58\frac{1}{2}'$ N., and has 8 feet on it at low water. The water is not discoloured over this rock, and it has not been seen to break there.

Sonapur is a village situated at the mouth of a small river in lat. $19^{\circ} 6\frac{1}{2}'$ N. It has a population of about 1,000 and possesses a post and sea customs office. Formerly it had some trade, but in 1890 no vessel had visited the port for more than 2 years. Two high white beacons, about 20 feet apart, stand on the beach about 7 cables N.N.E. of the mouth of the river.

Currents, Weather, &c.—The currents off the coast between Bimlipatam and Gopalpur are mainly influenced by the wind, the tide even at springs having very little effect on them. In December and January, when north-easterly winds generally prevail, the current, at one mile from the coast, sets steadily south-westward in a direction parallel to the coast, at a rate of one-half to three-quarters of a knot per hour. Towards the end of February the wind hauls round to the south-westward, and in March blows steadily from that quarter, generally falling light in the morning, and freshening up during the afternoon to a force of 5 to 6. The current then runs steadily to the north-eastward, parallel to the coast, increasing in strength with the distance off, its speed close inshore being about half a knot, but at 10 miles and upwards from the coast it frequently runs from 2 to 3 knots.

GOPALPUR, about 10 miles north-eastward of Sonapur, is the principal port in the Ganjam district. It stands on rising ground, and its white houses are visible from 12 miles seaward. The following are the conspicuous objects near the port :—Gopalpur Knuckles, about 14 miles westward of Gopalpur, consist of four peaks, the highest 2,887 feet, and are conspicuous on a clear day. Two isolated remarkable hills are situated about 8 miles northward

* See Admiralty chart :—Gopalpur to False point, No. 1125. The description of the coast between Gopalpur and Mahanadi river is from remarks by Commander A. Carpenter, R.N., in charge of Indian Marine Survey, 1889.

of the town ; Londabans, the eastern one, 570 feet high, presents a conical sugarloaf shape from every direction. Palur bluff, 17 miles N.E. from Gopalpur, and the north-eastern of the hills near the coast in that locality, would be a useful guide to a vessel set to the northward during the night. Mansurkota hill, rocky, isolated, and 168 feet in height, standing 2 miles northward of Gopalpur, shows over the sandhills. From a vessel approaching along the coast, the pier, 900 feet long, is very conspicuous ; it has 6 feet alongside at low water, but is not available for shipping. In the town the most prominent building is that of the British India Steam Navigation Company, on which the word *Gopalpore* is painted in large letters. The limits of the port are defined by whitewashed obelisks. Boats cannot enter the small stream which flows into the sea immediately northward of the town. The port flagstaff, painted white, is at the base of the pier, and is the only flagstaff on this coast which has a topgallant mast. During the fine season, from November to April, vessels load with rapidity ; at other times there may be delay.

LIGHTS.—A *fixed white* light is shown from the port flagstaff, at an elevation of 54 feet above high water, visible seaward from N.E. to S.W., and seen in clear weather from a distance of 12 miles. A *fixed red* light is shown from the end of the pier, at a height of 25 feet above high water, and is visible about 3 miles.

Tides.—It is high water, full and change, at Gopalpur at 9h. 40m. Springs rise $6\frac{1}{2}$ feet, neaps $4\frac{1}{4}$ feet

Anchorage in 7 to 8 fathoms, mud and sand, may be obtained as convenient off the town. Vessels working cargo usually anchor with the pier in line ; there is a hard patch of ground 4 cables eastward of the pier which it is well to avoid. In the windy months vessels should anchor in 9 fathoms, with a good scope of chain. The pier can only be used in the calms of January and February, at other times the outer line of breakers is close to its end. Landing is frequently impracticable in June and July. Ballast must be discharged outside the 12-fathoms line.

Communication.—There is a post and telegraph office in the town. Mails go by road and take 4 days to Calcutta, and 7 days to Madras. In 1891, a railway was in course of construction along the coast. A weekly steamer to Rangoon carries large numbers of emigrant coolies. In 1889, a canal was nearly completed, connecting Gopalpur and Ganjam, thence by Chilka lake to Puri. A B.N.I. steamer calls weekly.

Trade.—Shipping.—The exports are sugar, rice, hemp, hides, rum, myrabolams, gingelly, rape seed, and wooden sleepers, valued

in 1890 at Rs. 4,451,857. The imports, piece-goods, metals, and spirits, valued in 1890 at Rs. 1,913,399. The annual aggregate tonnage is about 225,000; and about 160 steamers visit the port each year. In 1890 Gopalpur was visited by 157 vessels of 214,088 collective tons.

Hospital, &c.—There is hospital accommodation at Gopalpur for seamen. The port is usually healthy, but cholera is occasionally imported by pilgrims returning from Puri.

Quarantine.—A vessel arriving with cholera, smallpox, or other epidemic disease on board, must report the case to the boarding officer on the earliest opportunity. There are special rules with regard to quarantine at Gopalpur, copies of which will be supplied by the boarding officer.

Supplies of bread, fresh beef, mutton, fowls and yams can be obtained. Fresh water is brought off in casks. Boat hire is one rupee per trip in fine weather. No repairs to shipping can be done, but spare anchors or spars can usually be obtained.

Winds, Weather, and Climate.—The locality from Gopalpur to Palur bluff is subject to strong winds, but cyclones appear to avoid the Gopalpur hills. The following table is the result of several years' observations at Gopalpur :—

Month.	Wind.		Force.	Weather.	Rain, inches.	Average Temperature.	Remarks.
	Day.	Night.					
January -	N.E. to S.E.	N.N.W.	2	Clear and fine.	Nil.	74	Very smooth.
February—	S.S.E.	Calm.	2	Do.	1	79	Occasional strong S.W. wind.
March -	S.S.W. to South.	S.S.W. to South.	4 to 5	Do.	Nil.	82	Wind lighter at night.
April -	S.S.W.	S.S.W.	5	Fine	Nil.	83	Do. do.
May -	S. by W.	S. by W.	4	Do.	Nil.	87	Very hot, occasional N.W. wind. Heavy surf.
June -	S.S.E. to	S.S.W.	5	Cloudy.	2	87	The quantity of rain falling in this month varies.
July -	S. by W.	S. by W.	4	Cloudy and wet.	7	85	Occasional N.W. wind. Heavy surf.
August -	S.S.W.	S.S.W.	3	Do.	10	83	Occasional N.W. wind. Heavy surf.
September	Chiefly South.	Variable.	2	Fine but wet.	8	86	Hot and oppressive.
October -	E.S.E.	N. by W.	2	Variable, wet.	11	85	The quantity of rain falling in this month varies greatly.
November	East.	N. by W.	3	Do.	6	79	Do. do.
December	N.E. to S.E.	N.N.W.	2	Fine and cool.	2	74	Sea smooth.

The south-west monsoon breaks about 15th June. The winds that blow along shore so continually near Gopalpur in March and April are met with farther north as occasional winds only, lasting for 2 or 3 days, and generally coming on a day or two before spring tides. The first intimation of these winds is the absence of any lull in the sea breeze during the night; they create an unpleasant sea for boats, and after blowing about 3 days subside as quickly as they rose.

STORM SIGNALS are shown at Gopalpur. For details of signals, *see* pages 27, 127.

Currents.—The currents usually run with the prevailing wind. In December and January there is a set to south-south-west of about one knot an hour 5 miles off the mouth of Devi river, farther out the current is stronger, and close inshore there is none. About 15th January a north-easterly set begins, and by the middle of February there is a steady east-north-east current, increasing in strength with the distance from the coast, and running half a mile an hour close inshore, up to $1\frac{1}{2}$ miles at 12 miles off. At the latter distance the direction of the current is about north-east by east, or inclined towards the shore, a fact against which vessels should be on their guard. The north-easterly current continues to run until the end of August, when the south-westerly set begins again, and gradually strengthens. Between March and August there is an enormous displacement of sand along this coast, and all the river mouths have narrow spits trending north-eastward from their entrances, which thus gradually move along the coast.

Population of Gopalpur, 2,859 in 1891, consists of Uriyas, Khonds, and Savaras. The Khonds are hill tribes.

Berhampur, 9 miles by road from Gopalpur, has a native population of about 22,000, and is a cantonment.

Ganjam, at the mouth of the Rushikulya river, 12 miles north-eastward of Gopalpur, and with several small fishing villages between, was formerly the capital of the district; but it is now in ruins, and very little of it is visible from seaward. The cemetery wall and north boundary pillar are generally visible in the morning; and $2\frac{1}{2}$ miles north-eastward of the cemetery are three remarkable clumps of casuarinas, which are perhaps the best guide for finding the place. There is however no trade at Ganjam, its produce being taken to Gopalpur or Puri by inland navigation. The Collector of the district

resides at Chatrapur, about 5 miles westward of old Ganjam. There is no shoal off the mouth of the Rushikuyla river. The Collector's bungalow is a conspicuous object from seaward.

Palur Bluff, 580 feet high, and backed by a saddle-shaped mountain upwards of 1,100 feet in height, forms a bold termination on the coast to the high ranges of the Ganjam district. This bluff, about 6 miles north-eastward of Ganjam, marks the southern limit of the great Chilka lake, which forms the southern boundary of the Mahanadi river delta.

THE COAST, a low beach of sandhills, backed by a little cultivation and grazing ground, stretches from Palur bluff 32 miles, north-eastward, to the entrance into Chilka lake. On this low coast there are few objects which can be identified from seaward. The most conspicuous mark is Mitakua bungalow, a small white stone building, on a sandhill 20 miles from Palur. Danai, a prominent sharp peak, 1,892 feet high, and N. by W. $\frac{1}{2}$ W. $21\frac{1}{2}$ miles from Mitakua, is a useful mark on a clear day. Chandikho mountain, 1,517 feet high, on the western shore of Chilka lake, stands out somewhat from the high ranges behind the lake, and from the southward shows as a double peak.

CHILKA LAKE is 37 miles long by 10 broad, and has a general depth of about 6 feet. The water is brackish, but there is no sensible tide in it. This lake is used for navigation between Ganjam and the Cuttack and Puri districts. The boundary between the Madras and Bengal Presidencies is near the south end of Chilka lake.

Rambha, an important village at the southern end of Chilka lake, has an extensive trade with Orissa, exporting salt, and importing grain, by means of peculiar boats built of flat planks. A steam launch plies between Rambha and the Puri end of the lake. The canal to Ganjam and Gopalpur is lessening the trade of Rambha.

Chilka lake entrance, $4\frac{1}{2}$ miles westward of Harchandi temple, is small and not easily seen. In the dry season there are about 3 feet water on the bar; and probably more during the rains, but the surf is then so high that the entrance is not used, cargo being taken either to Gopalpur or Puri. At the entrance, shallow water and breakers extend about 4 cables offshore, there being depths of 7 fathoms close outside them. In 1889 Danai peak bore N.W. $\frac{1}{2}$ W. from the

entrance, which had moved 3 miles E.N.E. between 1840 and that date. Babeswal temple, about 6 miles W.S.W. of Chilka entrance is sometimes visible amongst the trees ; it is black, and similar in shape to Puri temple, but is very small.

Harchandi temple, 18 miles E.N.E. from Mitakua bungalow, stands on a sandhill, and resembles Puri temple, but is much smaller.

Soundings.—Between Gopalpur and Puri there are no dangers off the coast ; the 10-fathoms line is about $1\frac{1}{2}$ miles from the coast and the 100-fathoms line at a nearly uniform distance of 18 miles off. The bottom near the coast is sand, between 10 and 23 fathoms depth it is sand and mud, and over 23 fathoms usually mud only.

PURI, locally known as Jagannáth (Juggernaut), is situated close to the sea on a low sandy ridge, $7\frac{1}{2}$ miles E.N.E. of Harchandi temple. The famous pagodas stand at the back of the town, three-quarters of a mile from the sea, on low land covered with small trees. They consist of three circular towers, decreasing in size towards the east, each crowned by a white dome ; and form a good mark from seaward in the forenoon. The western pagoda is 192 feet in height ; when bearing N.N.W. the three pagodas are seen separately ; when W. $\frac{1}{2}$ N., they are in line. The temple in which they stand is visited by many pilgrims, and the ceremony connected with the car of Jagganáth is still annually maintained, taking place in June or July. The fact that the west side of Puri pagodas appears perpendicular, while the east side slopes, the reverse being the case with Black pagoda, affords a means of distinguishing one from the other.

The sea front of Puri is about a mile long, the Collector's bungalow, circuit house, port office, and Europeans' houses, occupying the eastern part of the town ; on the western side are several walled temples, used in connection with the bathing festivities of the pilgrims. On the wall of the circuit house the word *Pooree* is painted. There is no coal depôt at Puri.

LIGHT.—A *fixed white* light is shown from a white tower on the parapet wall of the circuit house, at an elevation of 46 feet above high water, and is visible in clear weather 11 miles.

Signal station—Position.—The signal station flagstaff, painted white, S.E. of the big temple and close to the port office, is in lat. $19^{\circ} 47' 42''$ N., long. $85^{\circ} 49' 38''$ E.

Anchorage.—In fine weather there is anchorage in 7 to 8 fathoms anywhere off the town, with good holding ground. The bottom shelves rapidly to 7 fathoms, and then very gradually to 20 fathoms.

An old ballast ground in 10 fathoms, $2\frac{1}{2}$ miles S.E. by E. $\frac{1}{2}$ E. from the flagstaff, should be avoided as an anchorage.

Landing.—The usual landing is at the flagstaff; ships' boats cannot land at Puri in the finest weather.

Communication.—There is a post and telegraph office in the town, letters take 5 days to reach Calcutta. Traffic is chiefly carried on by the road to Cuttack, the capital of the Orissa district. Steamers only call occasionally. Puri is connected with the telegraph system of India.

Trade.—The chief export is rice, of the average annual value of Rs. 300,000; the imports, annual value Rs. 31,480, are principally gunny bags and pepper. About 21 steamers and 3 to 4 sailing vessels call in the year, the aggregate tonnage being about 33,000.

Hospital, &c.—There is hospital accommodation for seamen, if absolutely necessary, at the Municipal dispensary. Puri has no quarantine regulations. An epidemic of cholera usually follows each large influx of pilgrims, and there is generally some smallpox in the town.

Supplies are scarce; water can be brought off, but it is not recommended; sheep, fowls, eggs, rice, flour, sugar, and vegetables can generally be obtained. The charge for masula boats is Rs. 2 per trip. No repairs can be effected.

Weather.—Cyclones may be expected late in April, in May and June, and but seldom in July; they may also occur in October and November. The swell on the beach generally gives good warning of the approach of a cyclone.

The fine weather season is from 15th November to 15th March, when the sea breeze sets in about noon and blows moderately until 9h. p.m., being succeeded by the land wind until daylight, after which it is variable up to noon. After 15th February, and generally at spring tides, the sea breeze sometimes lasts all night, and blows freshly for 3 days, making a sea unpleasant for boat work. The rainy season is from May to November; August being the wettest month with an average rainfall of about $14\frac{1}{2}$ inches, the annual fall being nearly 40 inches.

STORM SIGNALS are shown at the Signal station, Puri. For details of Signals *see* pages 27, 127.

Tides.—It is high water, full and change, at Chilka lake entrance at 9h. 0m. Springs rise $4\frac{1}{2}$ feet, neaps 3 feet, and neaps range $1\frac{1}{2}$ feet. The mean level of the sea is one foot higher in November than in March; the soundings on the Admiralty chart of Gopalpur and Puri are reduced to the March tides, a foot more water than shown on them will therefore be found in October and November.

THE COAST from Puri trends about E. by N. $\frac{1}{2}$ N. for 24 miles to Tundaha, where there is an obelisk, 15 feet high, on the sandhills over the beach. From Tundaha the coast curves N.E. by E. $\frac{1}{2}$ E. 12 miles to the mouth of the Devi river, one of the branches of the Mahanadi. Although this coast, like that to the southward, is so low that it should not be approached at night or in hazy weather, it is free from dangers, and may be safely navigated by the use of the lead. Vessels proceeding along the coast should not shoal the water to less than 12 fathoms, remembering that there are 8 fathoms close outside the breakers. Bare sandhills from 20 to 70 feet high fringe the coast from Puri to Devi river; eastward of Black pagoda there are groups of trees behind them.

Caution.—No reliance should be placed on the apparent distance of the coast for judging a vessel's position, as, owing to the fine sand haze, all objects appear to be much farther away than they really are. At night the sandy beach blends with the water, and the tops of large trees, showing over the hillocks, appear as very distant objects on an obscure horizon. This is especially the case on moonlight nights, when vessels are tempted to follow the coast closely so as not to miss their ports, a circumstance which may happen through the action of strong and irregular currents. In the south-west monsoon a heavy surf breaks on the coast, and should a vessel touch the bottom, she is almost certain to be lost.

Baleswur temple, 7 miles E.N.E. of Puri, is a small black pagoda-shaped building with trees round it; standing half a mile from the coast, and with only its upper portion visible from seaward. At 14 miles from Puri is the mouth of the river Kushbhadra, a very shallow stream, with breakers at its entrance, but having no shoal off it. A small temple with two palms marks the mouth.

BLACK PAGODA (Kanakarak), in lat. $19^{\circ}53' N.$, long. $86^{\circ}6' E.$, although in a ruinous state, is still a most prominent object on this coast, being about 130 feet high, and seen from a distance of 18 miles seaward in clear weather. It stands $1\frac{1}{2}$ miles from the coast, on low land, with a few trees at its base, and presents the appearance

of the gable end of a house with a shoulder or roof sloping westward; from the north-eastward it shows up as a black pyramid.

The Kadu river mouth is situated 8 miles eastward of Black pagoda and one mile eastward of Tanhuda; the stream is shallow. In 1889, Nulyasai, a conspicuous fishing village on the sandhills, was 6 miles N.E. by E. of Kadu river, and 6 miles W.S.W. of the Devi river mouth.

DEVI RIVER (The Goddess).*—The entrance of Devi river, one of the largest branches of the Mahanadi and formed by the junction of the Great and Little Devis, is 18 miles E.N.E. from Black pagoda. The Devi flows through a low level district and reaches the sea at the eastern end of a long narrow tongue of sand. On the inshore bank of the river the country is a dense swampy jungle, with no inhabitants. Approaching from seaward, the only conspicuous objects are Nulyasai village, mentioned above, and a trigonometrical station obelisk on the sand-hills 2 miles northward of the entrance. On closing the river the breakers on the bar will be seen, and, from a sufficient height, the river itself over the sand spit. In 1889 there was a passage into the river, carrying 8 feet at low water, through a gap in the breakers about $1\frac{1}{4}$ cables wide. This channel was then one mile E. by N. of the long sandy spit, and the course in by the channel was N.W. When within the breakers on the port hand, a W.S.W. course led into the river with depths of 14 to 30 feet. In the south-west monsoon the entrance probably breaks right across. There is good anchorage inside in 3 fathoms, with the end of the dry sandy spit N.E. by E. about 6 cables. Small steamers, drawing 8 to 10 feet, might enter the river; at present there is little trade, light winds making the entrance difficult for sailing vessels in the fine weather season.

Central Sand.—The outer bank, trending S.E. from Central sand on the northern side of the entrance, does not always break in fine weather; it is the only danger off the river, and its edge is more than a mile from the line of coast. The obelisk, to the northward of the entrance, bearing westward of N.N.W., leads eastward of the bank; and a vessel passing should not shoal the water to less than 9 fathoms.

Landing.—In case of necessity, there is landing for boats, with southerly winds only, in the bight northward of Central sand.

Anchorage may be obtained with off-shore winds off Devi river

* See Admiralty plan of entrance to the Devi river, No. 756; scale, $m = 3.9$ inches.

in $8\frac{1}{2}$ fathoms, sand and mud, with the obelisk N. by W. $\frac{3}{4}$ W., and the gap in the breakers W. by N. $\frac{1}{2}$ N. ; or with onshore winds, with the obelisk N.W., in 8 fathoms.

Tides.—It is high water, full and change, inside Devi river mouth at 8h. 54m. Springs rise 9 feet, neaps $6\frac{1}{2}$ feet, and neaps range 2 feet.

THE COAST from Devi river mouth curves N.E. by N. 17 miles to the entrance of Jotdar river, and consists of low sandy beach with hillocks 15 to 20 feet in height. At two places the coast is so low that it is probable the sea washes over, in heavy weather, into the backwater behind. The Jotdar mouth is shallow, and has breakers across it always; in 1889 its position was marked by a ridge of high sandhills. The shallow mouth of the Harrichpur branch of Devi river is 4 miles north-eastward of the latter, and about $1\frac{1}{2}$ miles up the Harrichpur is the small post town of that name. The entrance to this stream cannot be seen from seaward. Magarkhia Tanda, a trigonometrical pillar, is 10 miles north-eastward of the Devi entrance. Beyond Jotdar river the coast trends N.E. by E. 12 miles to abreast False point lighthouse, and then bends northward round Dowdeswell island. Patakund river, very shallow and nearly 6 miles from Jotdar entrance, is marked by a trigonometrical obelisk, 15 feet high. The main entrance to the Mahanadi river is 5 miles farther north-eastward; in 1889 the breakers off the mouth extended one mile from the line of coast. Northward of Patakund river the land is low, but the lighthouse at False point and the new refuge house at Huki Tala are conspicuous landmarks.

Soundings.—Between Puri and Mahanadi, the 10 fathoms line is 4 miles off shore opposite Black pagoda, $1\frac{1}{2}$ miles near Devi river, and 5 miles distant abreast Mahanadi river. The 100-fathoms line averages 16 miles off shore until, eastward of Devi river, it begins to trend away from the coast. The nature of the bottom under 10 fathoms is sand; from 10 to 30 fathoms, dark mud; over 30 fathoms, soft grey mud.

MAHANADI RIVER,* (the Great River) has a course of about 520 miles, and receives many tributaries. Situated on the south bank of the principal stream of the delta is Cuttack, where a considerable trade is carried on in the produce of the Orissa district.

* See Admiralty charts:—False point to Mutlah river, No. 814, scale, $m = \cdot 26$ of an inch; False point anchorage, No. 755, scale, $m = 1\cdot 85$ inches; and, Admiralty plan, Entrance to Mahanadi river, No. 756, scale, $m = 3\cdot 95$ inches.

The rivers of the delta are subject to frequent changes. The branch of the river that enters the sea about $1\frac{1}{2}$ miles S.S.W. of False point lighthouse, was observed, in 1889, to have a long line of heavy surf extending from point to point across its entrance. The second or northern entrance, distant $1\frac{1}{2}$ miles E. $\frac{1}{4}$ S. from False point lighthouse, reported to have broken through in 1863, was also noticed to have heavy breakers extending across it. Inside, the Mahanadi river appears to have a navigable channel about 2 cables in breadth, carrying depths of from about 12 to 24 feet. The land at the entrance of the Mahanadi, and near False point lighthouse is low, intersected by numerous creeks, and the sea face is broken up into long narrow islands, joined together by shoal ground.

FALSE POINT LIGHT.*—Near the entrance to the river Mahanadi, or $1\frac{1}{2}$ miles west of Mahanadi point, and about $1\frac{1}{4}$ miles from the sea, is a stone lighthouse painted reddish-brown, with a white star facing the south-east. The height of the lighthouse is 132 feet, and from it is exhibited, at an elevation of 127 feet above high water, an *occulting white* light eclipsed for *four seconds* once in *every half minute*, visible from S.S.W. through west to N.E. $\frac{1}{4}$ N., and seen in clear weather at a distance of 19 miles. In January, February, and March, heavy fog on the land sometimes obscures the light, and in some instances causes it to show a deep red colour; during these months, vessels when approaching False point should take frequent soundings. The lighthouse should not be approached nearer than in 10 fathoms, which will be found at a distance of about 3 miles from the shore. A good guide when closing the land, and the light has not been seen, is to carefully examine the nature of the bottom, and if sand is found mixed with mud, the vessel's head should be put off shore till daylight.

Telegraph.—Vessels in the south-west monsoon can communicate with Calcutta by telegraph from False point lighthouse, by hoisting the usual signals of the International code. In the north-east monsoon, or with north-east winds, False point should be avoided, it being then a lee shore with generally a westerly current in the vicinity.

* The storm wave of a cyclone swept over False point September 22nd 1885, drowning the port officer and his family, with nearly all the inhabitants. The lighthouse remained intact. It is estimated that an area of 400 square miles was covered with sea water, and 700 villages wrecked. The buildings at Huki Tala, and nearly the whole of Reddie point, were washed away during the storm.

FALSE POINT ANCHORAGE* is formed by a tongue of land, extending from False point lighthouse in a north-east direction for a distance of 3 miles, meeting Dowdeswell island (Nurrea banga Nassi), which stretches nearly 5 miles to the northward, and is sometimes joined to the mainland. The principal feature of this coast is the range of small sand hillocks, averaging in height from 6 to 8 feet above high water, and covered with grass and scrub. The coast near the lighthouse is continually changing through alterations in the mouth of Mahanadi river.

Reddie point, the north-western extreme of the low northern end of Dowdeswell island, bears N. by E. $\frac{3}{4}$ E. 7 miles from False point lighthouse. The shape of the northern end of Dowdeswell island is continually changing.

Huki Tala, on the inner shore of Dowdeswell island, is the name given to the Harbour-master's station, where there is now a Refuge-house, painted white and easily seen from seaward, and a post and telegraph office.

Signal Staff.—The signal staff and storm signal station is at the western end of the Refuge-house at Huki Tala. This staff is 73 feet in height, and consists of a lower mast and topmast, with a yard, the whole painted white.

STORM SIGNALS are shown from the Signal Staff at Huki Tala. For details of signals, *see* page 27.

The inner shore of the bay, from False point lighthouse past Bakud creek, embracing what was formerly known as Plowden island, past the entrance to Jambu river and towards Temple point, is principally mangrove swamp. Temple point is a projecting point of trees, $1\frac{1}{2}$ miles north of the Jambu river entrance. From Temple point to the South Broni river the land is low, covered with grass and scrub, with occasional patches of mangrove swamp, fringed with sand, which forms the high water line. Further northward, the sand hills become more elevated, and the mouth of the North Broni creek forms a conspicuous gap between high sand hills. At the distance of 20 miles N.N.E. $\frac{1}{2}$ E. from False point lighthouse, the sand hill of Satbaia (with a solitary clump of trees) forms a good landmark, in case of a vessel getting too near the land when southward of Palmyras shoals.

* *See* Admiralty chart :—False point anchorage, No. 755.

Two channels lead inland from the anchorage—Jambu river to the northward; and to the southward Bakud creek, a short deep branch of the Mahanadi river. Bars intervene between the anchorage and these channels, but at high water, cargo boats and small steamers enter with ease. Tidal creeks, navigable by country boats throughout the year, connect False point with Dhamra and Brahmaní rivers to the northward, and with Devi river to the southward.

BEACONS and conspicuous marks.—Three beacons stand on the northern end of Dowdeswell island. A small one, which is surmounted by a cross, marks the northern extreme of Reddie point; two others are situated about half a mile southward of the point, one a screw pile beacon; the other a tripod, surmounted by a ball, the whole 40 feet in height. The coast about Reddie point is subject to change, and these beacons are moved as necessity arises. The screw pile beacon in line with the cross beacon, in 1891, was a good anchoring mark for large vessels.*

Three-quarters of a mile within Temple point, on the west shore of the bay, is a remarkable tree, the highest in the vicinity, and known as Temple tree, with a pole and black basket projecting from its summit, which bears from False point lighthouse N. by W. $\frac{1}{4}$ W. nearly 6 miles.

The Jambu location, consisting of a telegraph office, Public Works Department bungalow, and a Customs warehouse, is situated on the left bank of Sunta creek, and is conspicuous from the anchorage. The port officer and the Customs authorities reside here.

Marking the southern entrance point of the South Broni river, is an upright spar with topmast and black cage, situated about 3 miles N. by E. $\frac{3}{4}$ E. from Temple tree.

The only mark of importance on the southern shore is Prince Arthur's beacon, on the sand hills near Prince Arthur's point, consisting of a pole and cage, painted white, and bearing from False point lighthouse about N.E. $\frac{1}{2}$ N. $4\frac{1}{4}$ miles.

Buoys.—Fairway buoy, black and white chequered with staff and white cage, lies in $4\frac{1}{2}$ fathoms at low-water spring tides, about one mile N.N.E. from Reddie point. Outer western buoy, a black conical buoy, with staff and black cage, lies in 18 feet, about 3 cables north-westward of Reddie point, and indicates the western side of the Fairway channel. Spit buoy, a red can buoy with spire and red cage, indicates the north extreme of the sand spit off Dowdeswell island,

* These beacons cannot be depended on, as they are usually blown down or washed away when a cyclone passes over Dowdeswell island.

and also marks the eastern side of the Fairway channel. A small red nun buoy, westward of the Spit buoy, marks the extreme of the shoal water at the apex of the sand spit.

Four buoys denote the boundary of the inner anchorage ; on the western limit are two black buoys, and on the eastern limit, two red buoys ; each buoy lies in about 12 feet at low water.

NOTE.—All these buoys are moved as changes occur in the depths.

Anchorage.—The best anchorage for large vessels is northward of Dowdeswell island, in 4 fathoms mud, usually with tripod beacon and cross beacon in line ; or with Huki Tala signal staff S. $\frac{3}{4}$ E.

In the inner anchorage vessels can take up any position between the buoys marking the channel. Only vessels of less than 17 feet draught can load at this anchorage.

The channels in the harbour are liable to change, and inclined to silt up.

Tides.—It is high-water, full and change, at the inner anchorage off Huki Tala at 9 h. 15 m. ; ordinary springs rise 7 feet, neaps 4 feet. The range of tide is much affected by the fresh water out of the numerous creeks, and also by the prevailing winds ; the highest tides occur during the south-west monsoon, the lowest in the dry season. The tidal streams within the harbour set fairly through the several channels, and at springs average a velocity of 2 knots an hour. After heavy rains, when the freshets come down Bakud and Jambu rivers, the ebb stream, which runs out round Reddie point, sometimes attains a rate of 4 or 5 knots an hour.

At half a mile outside and eastward of Reddie point, the flood stream sets to the north ; at the Fairway buoy to the north-west ; whilst midway between the buoy and Reddie point, it sets west-south-west. Great attention, therefore, is necessary in entering the port on a flood tide.

In the offing, the flood sets north-east, the ebb south-west, each at a rate of about one knot per hour ; but the velocity is much influenced by the prevailing wind, so that the flood stream (augmented by the current) in the south-west monsoon attains sometimes a rate of 4 knots.

Communication.—There are post and telegraph offices at Huki Tala on Dowdeswell island ; and at Jambu, a short distance up the Jambu river. The steamers of the British India Company from Calcutta, Madras, and coast ports, usually call weekly.

Supplies.—Good water can be procured at the canal lock, about one mile up the Jambu river, by using the vessels' boats. Firewood is plentiful and cheap.

Provisions are scarce and expensive ; sheep and vegetables can be obtained from Cuttack, and from villages within a radius of 20 miles ; but it is better to obtain all provisions from Calcutta by means of the weekly British India steamers.

Trade.—Shipping.—False point is the principal port of Cuttack and the Orissa district, with which it is connected by the Kendrapara canal by way of Bakud creek and Marsaghai, the imports are chiefly Birmingham and Manchester goods ; exports, rice, and various seeds. Value of trade in the year 1890–91 was Rs. 30,071,842, an amount considerably above the average ; it is carried on chiefly with other Indian ports. In the year 1890–91 False point was visited by 77 vessels of 95,942 tons.

Ballast must be discharged outside the limits of the port.

DIRECTIONS.—A vessel from the southward, having made False point lighthouse, should not shoal the water to less than 10 fathoms until the lighthouse bears southward of W.S.W. Course may then be gradually altered to the westward of North, and when Temple tree and the buildings at Jambu are seen open northward of Reddie point, the anchorage may be steered for.

Vessels proceeding from the Húgli river to False point, should be 10 miles southward of Palmyras buoy before steering for False point ; remembering that with strong southerly winds the flood tide sets towards the coast about Satbaia.

If proceeding to the inner anchorage, pass westward of the red spire buoy off Reddie point (taking care to guard against an eddy extending from the pitch of the point to the 3-fathom line), and steer up the harbour keeping black buoys to starboard and red to port to the required anchorage.

With a strong flood stream (which will show itself by drifting a vessel rapidly to the northward), it will be found best to steer in on a southerly course, bringing the vessel's head through the S.E. quadrant, to east and north-eastward, so as to breast the tide before anchoring. Instances have occurred of steam vessels steering in towards Reddie point, and attempting to turn to starboard, or through south-west and north-west, on the flood tide ; thus they were rapidly swept across the channel to the westward, and grounded in the shoal water extending from Temple point.

Inner channels.—From abreast Huki Tala, boat channels, winding through mud-banks and partially buoyed, lead to the Bakud and Jambu creeks. There is also a channel, sometimes available for boats, through mud flats and mangrove, leading to False point lighthouse, the banks on either side being marked by bamboos. The channel to Jambu is the deepest, and at high-water is navigable for vessels of 10 feet draught. Bakud channel, although shallower than Jambu, is at present the highway to Cuttack. In navigating these channels, it is recommended that the services of a local pilot should be obtained, as they alter from time to time, necessitating frequent changes in the position of the buoys and bamboos which denote the fairway.

Climate.—The following table is from observations taken at Cuttack, at an elevation of 80 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		Mean.	Cloud.	Ins.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	72	85	60	25	38	65	1·7	0·4	1	29·96	·13
February - -	76	90	65	25	40	63	1·9	0·6	2	—·89	·14
March - -	83	98	73	25	39	62	2·3	1·1	2	—·81	·15
April - - -	88	102	78	24	37	62	3·0	1·5	3	—·70	·14
May - - -	89	100	79	21	35	65	3·8	3·2	8	—·61	·18
June - - -	86	95	80	15	30	74	6·6	10·7	15	—·50	·10
July - - -	83	90	78	12	21	81	7·5	12·6	22	—·50	·09
August - -	83	90	78	12	20	81	7·0	11·2	21	—·55	·10
September -	83	90	78	12	19	82	6·3	9·8	19	—·64	·11
October - -	81	90	74	16	28	75	4·2	5·8	10	—·78	·11
November -	75	85	65	20	33	68	2·3	1·0	2	—·91	·11
December -	70	82	58	24	34	66	1·7	0·5	1	—·97	·12

FALSE BAY.*—From the land on the west side of False point anchorage, the coast, trending N.E. $\frac{1}{2}$ E. for 19 miles to the entrance of the Maipara river and forming False bay, is moderately high, consisting of sand hills, but from Maipara point northward it is quite

* See Admiralty chart, No. 814, The Sandheads, False point to Mutlah river; scale, $m = 0\cdot26$ inches.

flat. About midway between False and Palmyras points, Satbaia sand hill, with an isolated clump of bushes at its north-east end affords a good landmark. In the southern part of False bay, the bottom is soft olive green mud, with regular depths decreasing gradually to the shore ; but in the northern part of the bay, the nature of the bottom changes from soft mud to a mixture of sand and mud, with rotten stones and broken shells, towards the southern edge of the sand banks, which extend seaward of Palmyras point and the mouth of Maipara river.

Caution.—On nearing False point from the eastward the water shoals gradually, but in approaching the shoal ground extending eastward from Palmyras point from the same direction, the water shoals suddenly from 13 to 9, 6, and 4 fathoms.

Maipara River is the southern outlet by which the waters of the Brahmaní enter the bay of Bengal about 5 miles south of the Dhamra river. Bansgarh, a tidal creek of the Maipara, runs south-west parallel to the coast till it enters the sea about 6 miles north of False point harbour. The Maipara river is deep, but its entrance is blocked by flats, which can only be crossed by boats at half tide in smooth water ; from November to March native craft engaged in the rice trade frequent the river.

Long Sand, on which the sea breaks heavily, stretches 4 miles north-eastward of the southern entrance point of Maipara river.

PALMYRAS SHOALS extend generally 8 miles eastward of Shortt island lighthouse, at the entrance of Dhamra river, and have depths of $1\frac{1}{4}$ to 5 fathoms over them. From their south-east extreme, where the depth is $4\frac{3}{4}$ fathoms, Shortt island lighthouse bears N.W. $\frac{1}{2}$ W. $8\frac{1}{2}$ miles.

Palmyras buoy, marks the north-east extreme of the shoals, and is moored with Shortt island lighthouse W. by S. $\frac{3}{4}$ S. 7 miles. This buoy is a white beacon buoy, with two red horizontal bands, surmounted by a staff and circular red disc. There are patches of $2\frac{1}{4}$ fathoms a short distance south-westward of the buoy.

CAUTION.—**Tidal streams.**—The tidal streams among the Palmyras shoals run at a rate of 2 knots at springs, and vessels should be on their guard against them when navigating in the vicinity. Near Palmyras buoy the flood sets about north-west and the ebb south-east. At the southern end of the shoals the direction of the flood stream is north, and that of the ebb, south. At Kanika buoy

at the entrance of Dhamra North channel, the flood sets from north-north-west to west-north-west ; and the ebb from south-east by south to south.

Anchorage may be obtained with strong north-west winds, in 7 fathoms, mud and sand, 3 miles south-eastward of the northern end of the sandhills on Maipara point.

Palmyras point is the north-eastern extreme of the low land, which separates the mouths of the Maipara and Dhamra rivers.

This point is covered by dark jungle and is difficult to distinguish ; all the land about is low, with palmyra trees growing here and there. A mud bank fringes this part of the coast, and dries seaward at low water for a distance of 2 miles.

DHAMRA RIVER,* the most important of the navigable rivers of Orissa, forms the northern exit of the united streams of the Brahmaní, Kharsua, and Baitarani rivers. The inner bar of the river changes both in depth and position ; but the outer bar, to the north of Shortt island, maintains fairly well its position and depth of water.

At about 9 miles from its mouth, the Dhamra branches into two streams ; to the north, the Baitarani, on which are situated the towns of Chandbali and Jajpur, follows a westerly direction ; to the south, the Brahmaní, takes a south-westerly direction, and communicates with Cuttack. At about 6 miles above the Baitarani junction, the Brahmaní river connects with the Maipara, and about 3 miles higher receives the Kharsua river, which again connects with the Baitarani above Jajpur.

Least depth in fairway.—As far as the village of Dhamra, 11 miles above the outer bar, the least depth to be passed over is on the outer bar, where in the South channel there are 13 feet at low water, and about 22 feet at high water springs. To Chandbali, up the Baitarani river, the least depth is about 6 feet at low water, and 15 feet at high water springs, on the Jhuta bar, about $1\frac{1}{2}$ miles above the junction of the Baitarani with the Dhamra. The draught of the steamers trading to the port of Chandbali is about 13 feet ; vessels of 15 feet draught could reach that port at high water springs, and of 12 feet draught at high water neaps.

PILOTS.—There are two native pilots for Dhamra river, one of whom is usually to be found at Shortt island lighthouse.

* See Admiralty chart of the Dhamra river, No. 754 ; scale, $m = 3$ inches.

Shortt island, off the mouth of Dhamra river, and 6 miles eastward of Palmyras point, is about half a mile long and a cable in width, with sands which dry at low water extending a mile southward and eastward, and nearly half a mile northward of it. The island is very low, the lighthouse being the most conspicuous object on it.

LIGHTS.—From a red lighthouse, 70 feet in height, on the highest part and near the centre of Shortt island, is exhibited a *flashing white* light, with alternate *flashes* and *total eclipses*, and an interval of *fifteen seconds* between the flashes. It is elevated 76 feet above the sea, and visible in clear weather 14 miles. Also, from the west side of the same lighthouse, a subsidiary light is shown, consisting of a *fixed* light, with narrow *red* and *green* sectors, separated by a *white* ray to define the fairway channel into the river; this light is elevated 37 feet above the sea, and is not visible except from the westward, or inshore, of the lighthouse.

Beacon.—A beacon, surmounted by a black basket, the whole 50 feet high, stands nearly a cable eastward of the lighthouse.

Kanika sand, beacon.—Kanika sand, 5 feet high, and said to be extending, is situated on the northern side of the channel more than 4 miles westward of Shortt island lighthouse. A beacon, with a cross, stands near the south-east end of the sand. A flat of sand and mud, which dries at low water, stretches one mile eastward, northward and westward of Kanika sand.

Kalibhanj island, trending east and west, divides the Dhamra river into two channels, at about 7 miles from the outer bar entrance. The northern is the navigable channel.

Dhamra village, on the north bank of the river, 10 miles above Shortt island, consists of a few straggling houses. A custom house is situated here, and a tide-pole indicates the depth of water likely to be met with on the Chandipal or inner bar.

Matai river, which joins the Dhamra river at about a mile westward of Dhamra village, is about a cable wide and said to be navigable at low water for craft of 8 feet draught.*

South channel buoys.—The buoys are moved as the channel alters, and their positions are therefore only given approximately. H is a red conical buoy, with the letter *H* on it in white, surmounted

* In the coast canal in course of construction to connect Cuttack with Calcutta, the Matai river is utilised as one of the natural connecting links, the junction occurring about 14 miles above the position at which the Dhamra and Matai rivers join.

by a staff and cone, and moored about $1\frac{1}{3}$ miles N.E. by N. from Shortt island lighthouse; this buoy marks the southern side of the entrance over the outer bar by South channel. G is a conical buoy, painted in black and white stripes, with the letter G in white on it, and is surmounted by a staff and globe. It is moored about W. by S. $\frac{1}{2}$ S, one mile from H buoy. This buoy is liable to break adrift.

North channel buoys.—Kanika buoy is black, with the letter K in white on it, and surmounted by two circular discs and staff. It is moored with Shortt island lighthouse S. by W., about $2\frac{3}{4}$ miles; and marks the entrance to the North channel.

E is black, surmounted by spire and basket of same colour, and is moored about $2\frac{1}{2}$ miles S.W. from Kanika buoy.

Inner buoys—D is a red can buoy, moored about $1\frac{1}{3}$ miles W. by N. of Shortt island lighthouse. The North and South channels meet north-eastward of this buoy.

C is conical, black, with staff and cage, on the north side of the channel about one mile westward of buoy D. B is a can buoy, red, with staff and cage of same colour. It marks the south side of the channel southward of Kanika bank, and is moored about W. by S. $\frac{1}{2}$ S., 2 miles from buoy C. Buoy A is conical, black, with staff and cage of same colour. It marks the north side of the channel southward of Kanika bank, and is moored about half a mile N.W. by W. $\frac{1}{2}$ W. from buoy B.

Inner Bar buoys are conical; that on the south side of the channel red, that on the north side black. They are moored about one mile westward of buoy A. From the inner bar, the channel, to abreast Dhamra village, continues clear of danger. Vessels drawing 20 feet may anchor off Dhamra.

Tides.—It is high water, full and change, at Shortt island at 9h. 44m.; at Kanika bank at 9h. 30m., and at Chandbali at 11h. Springs rise $9\frac{1}{2}$ feet, neaps 6 feet.

DIRECTIONS.*—In approaching Dhamra river the lighthouse on Shortt island will probably be the first object seen, and when that and the Palmyras buoy have been picked up, a vessel will have no difficulty in making the entrance. At night it is safe to approach with the light on a S.W. bearing, and a stranger should anchor when in 6 or 7 fathoms with the light S.W. With strong south-west winds there is good anchorage in 7 fathoms, N.E. $1\frac{1}{2}$ miles from Kanika buoy.

* These directions should be used with caution, the buoys being moved frequently, as the channel alters.

South channel.—In rounding Palmyras shoals vessels should not stand into less than 15 fathoms until Palmyras buoy is passed. Thence steer for H buoy, when near which the coast will be seen as a low dark line of trees, with the gap, made by the channel southward of Kalibhanj island, bearing W. by S. Immediately northward of the gap Kanika beacon will be seen on the bank on the north side of the channel. The channel northward of Kalibhanj island does not show as a gap until close to D buoy. In September 1891 the mark for the best water over the bar by South channel was to keep D buoy in line with, or a little northward of G buoy. Pass close northward of G buoy, and thence steer to leave D buoy 2 cables on the port hand, and C buoy the same distance on the starboard hand. Then bring B buoy well inside the south extreme of Kalibhanj island and steer right up to it, keeping it in that position; leave it on the port hand, and cross towards A buoy, passing close south of it, and thence for the northern buoy of the inner bar. When up to the last buoy edge away on a W. by S. $\frac{1}{2}$ S. course for about a mile, or until Chandipal beacon bears N. by W., when alter course to W. $\frac{1}{2}$ N. or with the distant north-west extremity of Kalibhanj island just open north of Kalibhanj perch. Pass the perch at a distance of a cable, and steer along, and about $1\frac{1}{2}$ cables from the north coast of Kalibhanj island, until Dhamra village bears N.N.W. distant a quarter of a mile. This is the anchorage for large vessels.

North channel has 8 to 9 feet at low-water springs, and in September 1891 was reported not to be available for navigation.

Continuing to Chandbali, bold water will be met with at a cable's distance from the north bank, from abreast Dhamra village to about $1\frac{3}{4}$ miles westward of the mouth of the Matai river, when the Celerity spit, marked on its south side by a black buoy, and which joins the bank extending from the western extremity of Kalibhanj island, will be reached, and the perch on Round point, on the south side of the river sighted.

Celerity spit frequently changes, and should not be crossed without a pilot, whose services should be retained for the upper part of the river and for the Baitarani to Chandbali.

BAITARANI RIVER, meaning "difficult to cross," enters the Balasor district at the village of Batipur, and flows for 45 miles in a south-west direction till it joins the Dhamra 5 miles from its mouth. It forms the boundary between Balasor and Cuttack. The country near the Baitarani is largely cultivated with rice. The entrance of the Baitarani is split into two channels by Luchinarian island, which

is about half a mile in length by a quarter of a mile in breadth. Of these, the northern is the navigable channel; the southern channel is only available for boats.

Jhuta bar is an under water junction of the west point of Luchinarian island with Pilot island, situated about half a mile to the southward. In 1886 the depth on Jhuta bar was only $6\frac{1}{2}$ feet, formerly it was 8 to 9 feet.

Pilot island, southward of Jhuta bar, is low and about 4 cables long in the direction of the river. Sand flats which dry extend from its north and south points, and between it and the left bank of the Baitarani river, is a narrow boat passage. The navigable channel lies between Pilot island and the eastern bank, the best track being nearer to the eastern bank. This part of the river is known as Pilot reach; a black buoy marks the south-west extreme of the spit extending south-west from Pilot island.

From the black buoy near the western end of Pilot reach, the river turns at right angles round Palmer point. On the western side of this part of the river is Sickie island, a bank which dries at low water. Between Sickie island and the western bank is a narrow boat passage.

A red buoy marks the western limit of Sickie island. The navigable channel lies close to the eastern side of the river, and curving to the westward changes over to the southern side at Sickie point, which forms the eastern boundary of Long reach.

Long reach runs in a westerly direction for about 2 miles, and around Borarria point, which is low. The north part of Long reach terminates in Hurripur bar, having on it about 8 feet at low water.

Hurripur reach has a northerly trend; the deepest water in this reach lies mid-stream. The latter part of the reach trends to the westward round Love point, towards which the deepest water lies.

Love point bar extends between Love point and Chandbali, and carries about 7 to 8 feet. The deepest water will be found a quarter of a cable from the southern or right bank up Love point reach, until travellers' bungalow bears North, distant about a cable. The three piers of Chandbali may now be distinguished, and anchorage picked up, in from 22 to 30 feet, off the town.

CHANDBALI is considered within the limits of the port of Dhamra. Of late years it is said to have risen in importance, and to have an improving trade. There is a police station, travellers'

bungalow, and customs office with warehouse ; also three landing piers, which have each a depth of 10 feet at their ends. The population of Chandbali in 1891 was 4,000.

STORM SIGNAL STATION.—A storm signal staff is erected near the custom house at Chandbali. For signals, *see* page 27.

Communication.—There is communication with Calcutta by steamer four times a week ; and with Cuttack by canal or by road.

Supplies of fresh provisions can be obtained at Chandbali in small quantities. No repairs to hull or machinery of vessels can be executed. No coal is kept in store.

Trade.—Shipping.—The exports are rice, jute, timber, oil seeds, hides, brass ware and tobacco ; the imports are piece goods, salt, oil, spices, copper and tin. In 1890 the aggregate value of exports and imports at Chandbali amounted to several millions of rupees. There is only a coasting trade at Chandbali, conducted principally in light draught steamers ; native vessels carry on a small trade for rice in the north-east monsoon. The aggregate tonnage of all vessels entering the port in 1890 was 61,727 tons.

Guire point, a sharp tongue on the south side of the river, opposite to, and about half a mile westward of Chandbali, terminates Love reach. Here the river turns sharply to the south-east, and continues navigable for the same draught of water that has reached Chandbali, for 2 miles.

A red buoy marks the termination of the shoal water off Guire point, and in ascending the river, should be kept on the port hand.

Mahurigaon, situated 2 miles above Chandbali, on the opposite side of the river, is not an important place.

CHAPTER V.

COAST OF BALASOR, RIVER HUGLI, SUNDARBANS, GANGES,
BRAHMAPUTRA AND MEGHNA RIVERS, WITH CHIT-
TAGONG COAST.

 VARIATION 3° E. IN 1892.

THE COAST from the north entrance point of the Dhamra river trends north for 4 miles to Balisai point, which is sandy, and in this vicinity the encroaching sea has detached several banks; the flats extend well out, and there is a depth of 3 fathoms 6 miles eastward from the shore. The coast then trends N.W. by N. for 13 miles to Bidiapur, and is low, muddy, and wooded with small scrub. Off Bidiapur the coast has retreated of late years, and landing is difficult owing to the softness of the mud. About 3 miles north of Bidiapur the coast trends to the northward, and as far as Kalikoti, is flat and faced with low mangroves. Off Kalikoti the 3-fathom line is $5\frac{1}{2}$ miles from the mangrove edge, and the bottom is of soft olive coloured mud.

Nauri is situated 11 miles N.N.E. of Kalikoti, the soundings off it being mud and sand. A small stream, the Gammal, enters the sea one mile south of Kalikoti, and another debouches just south of Nauri. Both are inaccessible at low water to anything but small boats. The Calcutta coast canal to Cuttack is a few miles inland from this part of the coast. At Nauri the coast becomes firm with higher trees and sand hilis, and so continues for 10 miles to Chandipur near the Balasor river. About half way between Nauri and Chandipur a large double pagoda shows out amongst the trees when viewed from the south-east.

BALASOR ROAD, in the north-west part of the bay of Bengal, is resorted to in the north-east monsoon for cargoes of rice, which have been brought down the Burabalang river. The largest vessels which ascend to Balasor or receive their full cargo in the river are of about 4,000 maunds (145 tons) burden.

Anchorage.—The best mark for making the anchorage is the highest part of the Nilgiri hills, situated $15\frac{1}{2}$ miles inland, bearing

about W.N.W. The holding ground is stiff mud, and the best anchorage for a vessel of 20 feet draught will be found with Chandipur flagstaff bearing N.W. by W. $\frac{7}{8}$ W., and the beacon on the north bank of the entrance to the river, N.W. $\frac{1}{2}$ W. This position will place a vessel about 7 miles from the flagstaff and $2\frac{3}{4}$ miles from the anchoring buoy, in 4 fathoms at low-water spring tides.

The coast near the mouth of the Burabalang, appears from the offing, sandy and barren. About 4 miles northward of the entrance, sand hills of mottled grey and yellow colour will be noticed, while on the fringe of low sand hills to the southward of the river, and bordering the coast, Chandipur flagstaff, near a large white bungalow, can be recognised.

BALASOR (BURABALANG) RIVER* rises among the Morbhanj hills, and after receiving the Gangahâr and Sunai runs into the sea at Balasor road. The tide runs up 23 miles. Native craft and steamers of 9 feet draught can navigate as far as the town of Balasor, or about 16 miles. Jimkhana bar, about a mile below Balasor, is an obstruction, extending between sand banks, and carrying over it from one to 2 feet at low water. The entrance of the river, 2 cables in width, is almost closed by a bar reaching seaward 2 miles from the river entrance, and which had over it, in 1883, at low-water spring tides, 2 feet of water; and with a south-east wind, was observed to break right across. The last quarter flood is the best time for crossing.

Chandipur flagstaff stands among sandhills 55 feet in height, close to the coast, at $1\frac{1}{2}$ miles south-westward of the river entrance.

LIGHT.—From the flagstaff, a *fixed white* light is exhibited, visible from N. by E., through west, to W. by S. It is elevated 62 feet above high water, and should be seen 10 miles.

Beacon.—On the north entrance point of Burabalang river, is a wooden spar painted white, surmounted by a basket, 35 feet above the ground.

Buoys.—In 1890, the following were the buoys at the entrance of the Burabalang river.

Anchorage buoy is black, with staff and cage; it has on one side an anchor, and on the other letter B, painted white. The depth at low-water spring tides at this buoy is 18 feet, and from it Chandipur flagstaff bears N.W. $\frac{3}{4}$ W. nearly 4 miles. By noting the depth at the

* See Admiralty plan of Balasor (Burabalang) road and river, No. 239; scale, $m = 1.95$ inches.

anchoring buoy and comparing with the chart, the depth on the outer bar and in the river generally may be estimated. A white buoy with staff and cage, lies with Chandipur flagstaff W.N.W. $2\frac{6}{10}$ miles. A red buoy lies with Chandipur flagstaff W.N.W. $1\frac{4}{10}$ miles. A black buoy, termed the "inner bar buoy," lies with Chandipur flagstaff W. by S. $1\frac{2}{10}$ miles.

A tide gauge is placed $5\frac{1}{2}$ cables westward of and inside the entrance of the Burabalang river; it is near the south or right bank, and about a cable westward of it is the landing pier, connecting with the road which leads to the town of Balasor.

DIRECTIONS.—As changes are likely to occur, the following directions must be used with caution. From close north-east of anchorage buoy steer for the beacon on the north entrance point of the river, about N.N.W. $\frac{3}{4}$ W., and pass close north-eastward of the white buoy which this course leads up to; from that buoy steer for Chandipur flagstaff, passing close northward of the next buoy; then edge to the northward, and when the beacon on the north entrance point is in line with the inner bar buoy, N. $\frac{1}{4}$ E., alter course to that, passing close westward of the black buoy, and keeping the same course until within a quarter of a mile of the beacon.

When crossing the bar, if the flood stream is running, a vessel must guard against being set to the northward.

The best course along the first reach, which trends W. by N., is near the northern bank until abreast Chota Ghira point, where the river takes a very sharp turn to S. by E.

The channel, after passing Chota Ghira point, is near the east bank of the river. This second reach runs S. by E., gradually curving round to S. by W., and is $1\frac{1}{2}$ miles in length. The central part is comparatively shoal, having depths, for half a mile, of 9 and 10 feet at low water.

Third reach doubles back on the second reach, running for a mile N. by E., then turns at right angles to the westward round Ghentí point. The channel, which in the bend has been near the southern shore, in the third reach changes to the eastern shore. The southern part of the third reach has from 9 to 10 feet of water.

The fourth reach pursues a serpentine, but on the whole, westerly course, and at 7 cables westward of Ghentí point is obstructed by Dinga bar. Between this bar and the northern bank the depth at low water is from 6 to 7 feet; and it is necessary to pick the way by means of the lead, borrowing throughout in the fourth reach, after passing Ghentí point, on the north shore of the river. Dinga bar

passed, the channel changes over to the south bank, and is deep until Whoarguddí is approached, where depths of 10 and 11 feet will be found.

Jungle point is the extremity of the peninsula, near Whoarguddí. The river here takes a sharp trend to the eastward, its general direction throughout the fifth reach being E.S.E. for $1\frac{1}{4}$ miles. This, the fifth reach, carries in its deepest channel depths of from 9 to 18 feet. Rounding Chargutia point, the river now enters sixth reach, extending in a westerly direction for $1\frac{3}{4}$ miles, terminating at Bubur point. The first part of the sixth reach has a north-westerly trend for 6 cables, where a detached sand bank, dry at low water, is half tucked into a hollow in the northern bank. The depth of the navigable part of the river in the sixth reach is from 3 to 10 feet, the channel passing south of the detached sand bank and then crossing to the northern bank. The deepest part of the river in this part of sixth reach is mid-stream between the sand banks, and then towards the northern shore ; again crossing to the south shore, as Bubur point is approached.

Seventh reach maintains a northerly trend, and extends for a mile. A sand bank, 4 cables long, by three-quarters of a cable broad, blocks up the greater part of it. On the east side of this sand bank is a narrow channel carrying 3 feet. The navigable channel lies on the west side of the sand bank, carrying depths of 3 feet. This part of the river is known as Bubur bar. The river from seventh reach winds round Nudiafa point assuming a south-westerly trend for a mile to Pukarabhar, then a direction of W. by N. for 7 cables to Jimkhana, and again a south-westerly trend for $5\frac{1}{2}$ cables, which brings a vessel to Muhammad Pau, which is the last point before Balasor port is reached.

Midway between Pukarabhar and Jimkhana, is Jimkhana bar of sand, over which, at low-water spring tides, is a depth of one foot.

About two cables north-east of Muhammad Pau point, the channel of the river changes over to the south bank, and from this position on to the custom house at Balasor, or a distance of 3 cables, continues near the Balasor or right bank of the river. Depths here will be found to vary between 10 and 22 feet at low-water spring tides.

BALASOR PORT, about three-quarters of a mile in length, fronts the town of Balasor. With the custom house bearing S.W., off Balasor, 10 feet at low water may be relied on, but the river here is only half a cable wide, and a vessel must moor head and stern.

Tides.—In Balasor road the ebb stream sets to the south-west, flood

to the north-east ; each about 2 knots an hour at spring tides. It is high water, full and change, at the entrance of Burabalang river at about 9h. 45m. Springs rise 12 to 13 ; neaps 8 feet. Off Balasor custom house at about 11h. Springs rise 10 and neaps 6 feet 6 inches. The stream of ebb is felt for 8 or 9 hours, and runs as much as 4 knots an hour ; that of flood is feeble, averaging about half a knot.

The Town of Balasor, established in 1642, was the site of one of the earliest English settlements in Eastern India. The original factory at Pippli (1634) was transferred to Balasor owing to the silting up of the Subarnarekha river. Balasor began to decline in importance as its younger rival on the Húgli gradually grew from a cluster of mud huts into the Calcutta of to-day.

Communication.—Balasor has telegraphic connection with Calcutta and Cuttack. There is weekly communication with Calcutta by steamer.

Supplies.—Provisions for vessels lying in Balasor road can be procured by special arrangement, either with the owners of cargo boats, or with the masters of the small steam vessels which ply to Calcutta. The river water off the town of Balasor at half ebb is fit for drinking purposes. No coal is kept in store at Balasor.

Trade.—Shipping.—The imports are piece goods, salt, oil, copper, and tin ; valued in 1890 at Rs.522,873. The exports are rice, jute, timber, oil seeds, hides, brass-ware, and tobacco ; valued in 1890 at Rs.688,090. Balasor is visited annually by about 75 to 100 small native vessels. Large vessels load in the roads during the north-east monsoon. The total aggregate tonnage of all vessels visiting the port and road in 1890 was 10,319 tons.

Cyclones.—From the position of Balasor roadstead, it is exposed to the full force of cyclones. Many disasters caused by these storms are on record. On October 31st, 1831, the storm wave accompanying a cyclone breached the trunk road to Calcutta, at a distance of 9 miles from the coast, and 26,000 people lost their lives. Native craft approach the coast as near as high water will permit. Should a storm come on it is said they have little to fear. Doubt arising as to weathering a storm, the best plan is to run a vessel into the western part of Balasor road, near Kalikoti, some 20 miles south of the entrance to the Burabalang river entrance, where the liquid mass of mud held in solution affords the best possible non-conductor to the violence of the sea.

STORM SIGNALS are shown at Balasor. For details of Signals *see* page 27.

Chanuya and Sartha are small ports on the Panchpara river, the mouth of which is 4 miles north-east of Balasor roadstead. The river bifurcates just within the entrance, and Chanuya village lies about 5 miles up the western, and Sartha about 8 miles up the eastern, branch. The bar has only about a foot at low tides, but within there is plenty of water, and native vessels of 100 tons burden enter, and ascend as far as Mahadani, 9 miles from the sea. Exports consist of rice and paddy.

THE COAST from the entrance of Panchpara river bends round for $12\frac{1}{2}$ miles in an E.N.E. direction, and has several sand hills, to the mouth of the Subarnarekha river, off the entrance to which is Pippli sand, which dries to a distance of 2 miles from the shore.

Subarnarekha port, the site of the first maritime English settlement in Bengal, is now insignificant and almost choked by sand banks. On the western side of the entrance to the river stands a pagoda and tope of trees. The channel, nearly dry at low water, is on the south-west side of Pippli sand. The river is said to be fairly deep within, and navigable for country craft for about 16 miles. During the rains, rice boats of 2 tons penetrate far up the Subarnarekha, which has a tortuous course of 317 miles. On the Eastern bank about 20 miles from the sea is Jaleswar (Jellasore). The port is principally visited by fishing boats, which in fair weather issue out in squadrons and sail down the coast as far as Puri.

Anchorage may be had off the mouth of the Subarnarekha river in 5 fathoms, mud, distant 8 miles from the shore, eastward of Pippli sand, with the pagoda bearing N.W. by N.

THE COAST, eastward of the entrance to the Subarnarekha river, trends E.N.E. for about 10 miles to the Birkul bungalows, and is generally sandy; between is a sand hill known as the Quoin. At a distance of 3 miles eastward of Birkul bungalows is the mouth of the shallow stream Digwah Mohan, and at 4 miles farther the entrance to Munder Mohan, a similar stream. Various creeks, including Sola creek, then occur, until the mouth of Rásulpur (Hijili) river is arrived at. The whole of this extent of coast is low and without objects recognisable at any distance from the offing. The small vessels that frequent Rásulpur river, in their passage

from the westward, use a narrow channel close inshore, which has depths of from 3 to 6 feet, but requires local knowledge.

COWCOLLI LIGHTHOUSE,* on the west side of entrance to the Húgli river, is situated north-east of the entrance to the Rásulpur river, and about 7 cables inshore. It shows a *fixed white* light visible from N. by W. to W.N.W., elevated 62 feet above high water, and should be seen 12 miles in clear weather. The lighthouse is built of brick, painted white.

PILOTS RIDGE is the bank or shelf which borders the coast off False and Palmyras points in the direction of the entrance to the river Húgli, and affords an excellent guide for vessels approaching the river, as the bottom to 20 or 23 fathoms consists of shelly sand and gravel of a reddish colour; while more to the east or seaward, it is of sand and mud with shining specks, or olive-coloured mud with broken shell. The eastern edge of the ridge is rather steep, the soundings seaward of it being from 28 to 30 fathoms.

PILOTS RIDGE LIGHT VESSEL, in about lat. $20^{\circ}46'30''$ N., long. $87^{\circ}31'45''$ E., is placed in position from the 15th March to 31st October, in 21 fathoms, near the eastern edge of Pilots ridge, with the station buoy, which is white, surmounted by a double cone, and marked P. R., bearing North, distant $1\frac{1}{2}$ miles. By day, the light vessel may be recognised by a ball with a half ball above it, at the main masthead, and *Pilots ridge*, painted in white letters, on her side. By night, at an elevation of 44 feet, and visible at a distance of 12 miles, is exhibited a *flashing white* light showing a flash *every minute*, the duration of each flash being about *ten seconds*, and the eclipse *fifty seconds*. A blue light is burnt every hour between 7 p.m. and 5 a.m.†

Fog Signal.—During thick and foggy weather a bell is sounded from Pilots ridge Light-vessel.

Tides.—It is high water, full and change, at the Pilots ridge at

* Cowcolli roads was a general anchorage, and the main ship channel for vessels, as late as 1861–62; but this part appears to be silting up fast, and the channel between Mizam and Auckland sands is constantly altering, and requires careful navigation.

† In the approaches to the Húgli river, light-vessels out of position at night show a fixed red light at bow and stern, a red flare every quarter of an hour, the station light is put out and if in danger they fire rockets; by day, distinguishing marks are struck and name covered over. All light-vessels during fogs ring a bell at intervals of not more than two minutes. The hulls are painted red, and each light-ship exhibits at night a riding light on the forestay, 6 feet above the rail. The name of the station is painted on the hull in white.

about 9h. 50m.; springs rise 9 ft. and neaps 7 ft., neaps range 5 ft. 9 ins. (March to September approximate only).

Tidal streams.—From the latter end of June to the end of November, there is little or no flood or westerly set off False and Palmyras points except at spring tides, but a strong outset is often found, caused by freshets from the rivers. Seaward of the Sundarbans strong rotatory tides prevail, setting at different times to every point of the compass. The flood begins running west, at the end of the first quarter its direction is W.N.W., at half-flood it runs about North, and during the last quarter E.N.E. The ebb stream begins at East, at half-ebb it runs about South, and during the last quarter ebb W.S.W.; thus making a complete rotation.

EASTERN CHANNEL LIGHT VESSEL, in about lat. $21^{\circ} 0' N.$, long. $88^{\circ} 12\frac{1}{2}' E.$, is moored at the entrance to Eastern channel in 10 fathoms, with station buoy North, one mile, and Lower reef buoy N.W. $\frac{1}{4}$ N., 6 miles. She is painted red, and has three masts, with a black ball at main, and *Eastern channel* in white letters on the side. Displays 44 feet above the water a *flashing white light* showing a flash *every thirty seconds*, the duration of each flash being about *five seconds*, and the eclipse about *twenty-five seconds*; which should be visible 12 miles in clear weather. Also carries a riding light on the forestay 6 feet above the rail.

During the south-west monsoon (15th March to 31st October) a blue light is burnt every half hour between 7 p.m. and 5 a.m. In the north-east monsoon, or from 1st November to 14th March, a blue light is burnt every hour between 7 p.m. and 5 a.m.

Fog Signal.—During fogs a bell is rung every 2 minutes.

Tides.—It is high water, full and change, at the Eastern channel light-vessel at 9h. 27m.; springs rise 11 ft. and neaps 7 ft. 11 ins., above lowest low water spring tides, of the dry season, neaps range 4 ft. 6 ins.

In the Eastern channel the tides set as follows, when not influenced by the wind; 1st quarter flood, N.W. by W.; 2nd quarter N.N.W.; 3rd quarter N.N.E.; last quarter E.N.E.; 1st quarter ebb, S.E. by E.; 2nd quarter S.S.E.; 3rd quarter S. by W.; last quarter S.W. and W.S.W. The streams generally run in the directions of the channels, at rates of 2 to 3 knots at springs, and one to $1\frac{1}{2}$ knots at neaps.

South channel buoy, with S.C. painted on it, and surmounted by a basket, is moored in about 10 fathoms, N.E. $\frac{3}{4}$ E., 23 miles from Pilots Ridge light-vessel, and W. $\frac{1}{4}$ N. 13 miles from Eastern channel light-vessel.

PILOT BRIGS, Cruising station.—During the south-west monsoon they endeavour to cruise about 4 miles to the south-westward of the Eastern channel light vessel, the supply brig, as a rule, taking the outer position. During the north-east monsoon they cruise or anchor from 3 to 4 miles to the north-westward of the same light vessel. The brigs are of about 300 tons, painted black, with white stripe, imitation ports, and double topsail yards.

Pilotage is compulsory for all merchant vessels over 100 tons.

CAUTION.—Vessels approaching the station during the day must show the usual signal for a pilot, and by night fire guns, burn blue lights, and exhibit two lights in a vertical position where best seen; but sailing vessels should avoid as much as possible running for the station at night, or in threatening weather; under such circumstances put the vessel under snug canvas while well out in deep water, and keep the sea.

Vessels arriving at the Sandheads and finding the supply pilot brig at anchor, should use caution in closing her on account of the strong tides. When easterly winds prevail, there is a strong set to the westward; it is then specially incumbent on strangers to take advice given from the brig. Vessels coming in at night should never heave-to to windward of the brig if they intend to take a pilot before daylight, but close as soon as possible, approaching round the brig's stern, whether at anchor or underway.

In August, September, and October, when sailing vessels are signalled to keep to windward, they should be careful to keep the light vessel or brigs in sight, for should the wind fall light they are liable to be set out to sea, and, particularly in the two latter months, may not be able to return for many days. The lead should be used frequently. Signals from the brig "to prepare for bad weather," should not be ignored. Study the tide; the first of the flood setting to the Westward, stand to the Eastward; the first of the ebb setting to the Eastward, stand to the Westward and Northward. A kedge anchor is useful. Strangers anchoring off the light-vessel, should endeavour to near the brigs, and not remain at anchor. The practice of rounding the brig close-to, in a sea-way, is dangerous, both to the brig and to the boat alongside.

Distinguishing signals used by the pilot brigs.—A red flag at the main informs inward-bound vessels that the brig will supply a pilot, and should be made for without hesitation, irrespective of the other brig. At night, the supply brig attracts the attention of inward-bound vessels by showing a flare-up light at short intervals.

Should an inward-bound vessel on arrival at the Sandheads find neither of the pilot brigs with the red flag flying at the main, it may be concluded that there are no pilots on the station.

The buoy brig, *i.e.*, the brig that takes out the pilot from outward-bound vessels, hoists a white flag at the fore.

Inward-bound steam vessels should, when within signal distance, indicate gross tonnage to the pilot brig, which cannot supply them with a pilot until this information has been given. Steamers on closing the pilot brig should lie-to under her stern or weather quarter, and, after the pilot is on board, tow the boat to windward of the brig.

Sailing vessels should invariably lie-to on the same tack as the pilot brig, unless signalled to the contrary, and should show net tonnage.

DIRECTIONS for sailing vessels approaching the mouth of the river Húgli.*—In the south-west monsoon the land should be made on the Orissa coast about Pundi, or between it and Ganjám, where it is high, for in the latter part of March, and early in April, the weather is generally hazy, preventing the land from being discerned, unless very near; a vessel ought not to get to the northward of Puri (Jagannáth pagoda) before closing the coast (*see* page 163).

In the night, or in thick weather, the lead, and Puri *fixed white* light, which is visible 11 miles, will be a good guide, the 20 fathoms line is 12 miles off shore south-eastward of Puri, but only 3 miles off abreast Ganjam. When the position is known, steer along the coast keeping in 18 or 20 fathoms in the night, or with unsettled weather; with daylight sight Jagganáth and Black pagodas in passing. At night do not come under 15 fathoms, the coast is low, and it will not be seen unless close to. In hazy weather the noise of the surf would probably be the first indication of being near the coast.

When about 10 miles past Black pagoda steer so as to obtain proper soundings off False point (*see* page 168). The depths decrease gradually towards the bank surrounding False point, but keep in 14 or 15 fathoms at night when passing it, or in 20 fathoms if the wind is south-east. The flood stream there inclines towards the shore, and the ebb from it.

When False point bears W.N.W. and the vessel is in 14 or 15 fathoms, steer north-eastward and make the Pilots Ridge light-vessel, steering thence for the Eastern channel light-vessel.

* Abridged from a pamphlet published by the Admiralty in 1857.

The above directions are given while the monsoon prevails steady from the south-west and westward, but towards the close of the monsoon, or in September, this route is likely to cause inconvenience and delay, for the wind then often hangs to the eastward, and the current sets strong to the south-west. During that month, if the latitude can be observed, or the light on False point can be recognized, there is little occasion for making the land so far to the southward.

In the north-east monsoon, a sailing vessel, if on the east side of the bay, should steer direct for the Eastern channel light-vessel; or when near the head of the bay, work up, making short tacks southward of that light-vessel.

Special Quarantine Regulations.—Any vessel arriving at the Sandheads from a port where plague, yellow fever, typhus, or other fatal epidemic not ordinarily known in India, prevails, shall hoist and keep flying a yellow flag, and indicate by signal the port from which she has come. And no communication is to be held with the shore, or with any other boat or vessel, with the exception of the boat supplying the pilot, his leadsman, servant, and baggage, until the Health officer has visited the vessel at Diamond harbour; when further directions will be given to meet the case.

There are special signals to be shown by vessels with cases of smallpox, cholera, measles, or other epidemic diseases common in India, or of diphtheria, or scarlatina, on board; or, if two or more deaths from suspicious causes have occurred during the voyage. The case is to be reported to the pilot immediately he boards the vessel, when he will give instructions as to the signals to be hoisted.

WEATHER at the Sandheads, commencing from the breaking up of the south-west monsoon in the month of September, may be expected as follows :—

Month.	Wind.	Force.	Weather.	Remarks.
September	Easterly -	Light and variable.	Showers of rain -	Westerly set depending on force and duration of the easterly winds. Atmosphere generally clear.
October -	Easterly and calms.	Variable -	A stormy month, sultry at times.	Westerly and S.W. set. A gale or cyclone generally expected.
November, December, January.	Northerly in morning and evening.	Fresh in morning and evening, calm mid-day.	Fine weather with cool morning and evenings.	A cessation of the strong tides of the Hugli. Fogs in January in the morning.
February-	Variable, southerly at night.	Light - -	N. Westers sometimes. Warm towards end of month.	Heavy fogs in morning. Floods strong in Hugli towards latter part of month.

Month.	Wind.	Forec.	Weather.	Remarks.
March. April, May.	Unsettled until end of March, then westerly, and S.W. in April and May.	Light at first, sometimes strong at end.	N. Westers with rain, thunder and lightning frequent.	Flood tide accompanied by bore at times. Weather hazy. April and May S.W. winds, sometimes a gale or cyclone.
June -	S.W. strong at first.	Strong - -	N. Westers, lose their strength. Heavy thunderstorms.	In June the "chota bursat" or small ruin commences and generally lasts a fortnight.
July -	S.W. - -	Strong - -	Squally and heavy rains.	Westerly gales frequent. Freshets in the river. Much swell in the Eastern channel.
August -	S.W. and westerly.	Lighter than in July.	Similar to July -	Strong westerly set at Sandheads. Atmosphere generally clear. Wind from westward during day, hauling to southward towards evening.

HÚGLI (Hooghly) RIVER, the most westerly, and for commercial purposes the most important channel by which the Ganges enters the bay of Bengal, takes its name near the town of Santipur about 120 miles from the sea. It is made up by the united streams of the Bhagirathi, Jalangi and part of the Matabhanga. These three western distributaries of the Ganges are known as the Nadiya rivers, and it is owing to the engineering attention paid to their conservancy that Calcutta has not shared the fate of almost every deltaic capital in India, by the silting up of the river upon which its prosperity depends. Much attention has also been paid to the conservancy of the port of Calcutta itself, rendering the Húgli a safe water-way to that port, for vessels of even 26 feet draught.

The chief difficulty to navigation is 30 miles below Calcutta, at the James and Mary sands, which are formed by the entrance into the Húgli on its western side of the Dámodar and Rupnarayan rivers, draining south-western Bengal, and with the Húgli depositing vast quantities of silt forming banks and quicksands, the ship channels through which have to be watched and sounded daily. The state of the channels is signalled from the bank to each ship on passing. Diamond harbour, below the James and Mary sands, where vessels formerly anchored to discharge cargo and passengers, is now a village, and but seldom used, even the largest vessels proceeding the whole way to Calcutta.*

* See Admiralty chart of Húgli river, Calcutta to Saugor point, No. 136; scale, $m = 0.9$ of an inch. The soundings on the Húgli river charts are reduced to the lowest tide of the dry season (December to April). In Calcutta, the datum is Kidderpur Dock sill, the value of which is 6.25 feet below mean sea-level, and to which all the Port soundings are reduced.

On the left or eastern bank, the Húgli is connected by various tidal channels and creeks with the network of distributaries by which the Ganges enters the sea ; some of these forming waterways for boat and steamer traffic from Calcutta through the Sundarbans to Eastern Bengal and Assam. For practical purposes the sea may be said to commence at about 83 miles from Calcutta, but the Eastern channel light vessel lies about 122 miles from Calcutta. At the entrance between Saugor island and Khijiri (Kedgeree), about 68 miles from Calcutta, the river is nearly 7 miles in width. From this, for many miles to the southward extend a long line of sands, liable to change, which separate the various channels, and generally take a north and south trend, for the position and peculiarities of which the chart affords a better guide than any written description.

Least depth in Channel.—To Saugor roads, the least depth to be passed over from the bay, by Eastern channel, is 19 feet at low water springs, and about 30 feet at high water neaps ; situated near the upper Gaspar light-vessel. The Húgli, to Calcutta, can be navigated by vessels of 26 feet draught at high water springs, and 22 feet draught at high water neaps, when the river is high, from June to October, and by vessels of 24 and 20 feet draught at those times of tide, when the river is low, from October to June.

NOTE.—The banks and soundings in the Húgli are so continually altering, that above Saugor road the river must be considered as strictly pilotage water ; and consequently no description of its shores or channel, or directions for its navigation, are given in this work.

EASTERN or SAUGOR CHANNEL,† the main ship entrance, lies between Saugor sand and Eastern Sea reef, and extends from the Eastern channel light-vessel to the Lower Gaspar light-vessel, or about N. by W. $\frac{3}{4}$ W. $27\frac{1}{2}$ miles. The deepest water is found on its eastern side near the edge of Saugor sand, where the bottom is generally a soft but sticky clay, in which the lead sinks deeply.

INTERMEDIATE LIGHT VESSEL placed in position from the 1st February to 30th November (inclusive), is moored about N. $\frac{1}{4}$ W. 14 miles from Eastern channel light-vessel, in a depth of 42 feet, and with the station buoy S. 45° E., $1\frac{1}{2}$ miles, and wreck buoy N. by W. one mile. This vessel is painted red, has three masts, carries a black ball at the fore and mizen mastheads and has *Intermediate* painted in white letters on the side. Shows a *fixed white* light 48 feet above the water, visible 12 miles in clear weather ; the riding light on the forestay is 6 feet above the rail.

† For the Western channel see Admiralty chart of the Sandheads, No. 814.

LOWER GASPAR LIGHT VESSEL is moored in the Gaspar channel in 27 feet of water N. by W. $\frac{1}{4}$ W. $13\frac{1}{4}$ miles from Intermediate light vessel. This vessel is painted red, has three masts, and carries a black cone at mainmasthead, and has *Lower Gaspar* in white letters on the side. She exhibits a *fixed white* light 48 feet above the water, visible 12 miles in clear weather, carries a riding light on the forestay 6 feet above the rail, also burns a blue light at the half hour.

During the time the Intermediate light vessel is not on her station (*i.e.* from 1st December to 31 January) the Lower Gaspar lightship from sunset to sunrise burns a blue light at the hour in addition to the one usually burnt half an hour after each hour.

Fog Signal.—During fogs a gun is fired from this light vessel at the hour and half hour.

GASPAR CHANNEL is a continuation of the main ship channel into the Húgli, and extends north-westward from the upper part of the Eastern channel to the lower part of Saugor roads, or between the Lower Gaspar and Long Sand light vessels, for a distance of 11 miles. The best water through the Gaspar channel, 19 feet, is found by keeping in a line between the Upper and Lower Gaspar light vessels, and after passing the Upper light vessel where there is shoal water for a mile or two, to keep the Lower light vessel on with the Upper light vessel, until Saugor light-house bears N. by E. $\frac{1}{4}$ E.

During the south-west monsoon there is usually a high sea in the Gaspar channel. The water shoals gradually from 27 feet abreast the Lower Gaspar light vessel to 19 feet in the narrowest part of the channel between the two centre Gaspar buoys; it then deepens a quarter of a fathom, but carries no more than 21 feet, till well past the Upper Gaspar light vessel and well over towards the eastern edge of the Long sand. There is generally too much sea to tack a ship in the south-west monsoon, so that unless the wind allows a vessel to lay through N.W. $\frac{1}{4}$ N., with an allowance for tide, the passage of the Gaspar channel should not be attempted by a sailing vessel.

Buoys.—In Gaspar channel the western side is marked by black buoys with open baskets; and the eastern side of the channel by red buoys with globes.

Tides.—It is high water, full and change, at the Lower Gaspar light vessel at 10h. 13m.; springs rise $15\frac{1}{2}$ ft.; neaps rise 12 ft., and range $6\frac{1}{2}$ ft. Both flood and ebb streams are inclined to set across the channel especially in the last quarter of each tide.

UPPER GASPAR LIGHT VESSEL is moored in the Gaspar channel in 21 feet N.W. $\frac{1}{2}$ N., $5\frac{3}{4}$ miles from Lower Gaspar light vessel. This vessel is painted black, carries a black drum at mainmast-head, and *Upper Gaspar* in white letters on the side. She exhibits a *fixed white* light 24 feet above the water, visible in clear weather 9 miles, also carries a riding light on the forestay 6 feet above the rail.

Fog signal.—During fogs a gun is fired from this light vessel every first and third quarter of the hour.

Tides.—It is high water, full and change, at the Upper Gaspar light vessel at 10h. 20m., springs rise $15\frac{3}{4}$ ft.; neaps rise $12\frac{1}{4}$ ft., and range $6\frac{1}{2}$ ft.

LONG SAND LIGHT VESSEL, in position all the year round, is moored eastward of the Long sand about S. by W. $\frac{1}{4}$ W., $5\frac{1}{2}$ miles from Saugor lighthouse, in 22 feet of water at lowest low-water spring tides, and with Gaspar light vessels in line S.E. $\frac{1}{2}$ S.

This vessel is painted red, carries a small black ball over a larger one, and has *Long Sand* in white letters on her side. She exhibits a *fixed white* light 24 feet above the water, visible in clear weather 6 miles; and a riding light 6 feet above the rail.

SAUGOR ROADS.—The channel northward of the Long sand light vessel continues between the Long sand to the westward, and Middleton sand to the eastward, for about 6 miles, or until off the south-west point of Saugor island, on which is a lighthouse; here the water deepens to more than 5 fathoms, and is known as Saugor road. Although in ordinary weather there is safe anchorage in Saugor road, yet in heavy gales a considerable swell rolls in at high water.

Tides.—It is high water full and change, in Saugor roads at 10h. 20m. Springs rise $15\frac{3}{4}$ feet, neaps $12\frac{1}{4}$ feet. The tide runs fair up and down Saugor roads; but below, where the dry portion of the Long sand permits it, the tide has a tendency to flow round the compass, especially the last of the ebb, which sets S.S.W. and S.W.

SAUGOR LIGHTHOUSE is situated near Middleton point, Saugor island, and exhibits a *fixed* and *flashing white* light visible from N.W., round by east to South, the interval of revolution or flash being *twenty seconds*; the light is elevated 74 feet, and seen 15 miles in clear weather. The lighthouse built of twelve iron cylinders, is painted in alternate red and white horizontal bands.

SAUGOR ISLAND, of low alluvial soil, covered with impenetrable jungle, except some clearances on its eastern side, is

intersected with numerous creeks or khalls, and infested with wild animals. On the eastern side of Saugor island are some large villages, where the land is cleared and cultivated; also Government salt works. No attempt should be made by a shipwrecked crew to cross the island to the lighthouse, but the coast line must be followed round and the creeks crossed in preference. (For position of refuge houses on sea face of Sundarbans, *see* page 203.)

Signal Station.—Telegraph.—Saugor lighthouse is connected with Calcutta by telegraph.

STORM SIGNALS.—1. When a severe cyclone (often accompanied by a storm-wave) is approaching the Bengal coast, signals are hoisted at flag-staffs near the lighthouse on Saugor island, near the telegraph office at Mud point, and near the telegraph office, Diamond harbour.

Day signal No. 1,
bad weather
signal.



A ball indicates severe cyclone in bay of Bengal, as yet too distant to enable its track to be determined.

Day signal No. 2,
danger signal.



A cone, early probable passage northward and to the eastward of Saugor island and west of Chittagong, of the vortex of severe cyclone. No sailing vessels, nor deep-laden, nor slow steaming steam-vessels should go to sea. The wind at the mouth of the Húgli will probably haul from north-east through north to north-west, &c.

Day signal No. 3,
danger signal.



An inverted cone, early probable passage northward and to the westward of Saugor island and north of False point, of the vortex of severe cyclone. The wind at mouth of Húgli will probably veer from north-east through east to south-east, &c.

Day signal No. 4,
great danger
signal.



A drum, approach of a severe cyclone to mouth of Húgli. Masters and pilots are cautioned not to put to sea from Saugor island, or to proceed down from Diamond harbour, and should make their vessels secure.

2. When a small cyclone (not often accompanied by storm-wave) is advancing towards the coast, one or other of the following signals will be hoisted at the staff near the lighthouse at Saugor island, at Mud point, and near the telegraph office, Diamond harbour, Calcutta.

Day signal No. 5,
bad weather
signal.



Two cones, the upper one inverted, indicate small cyclone in the bay of Bengal, which will probably reach and cross the coast of the bay south of a line joining Chittagong and False point.

Day signal No. 6,
warning signal.



Two cones, the lower one inverted, indicate existence of small cyclone, which may reach and cross the coast of the bay, north of a line joining Chittagong and False point, but the path of vortex doubtful.

Day signal No. 7,
warning signal.



A ball below a cone indicates passage northwards and to the eastward of Saugor island and west of Chittagong of small cyclone, of kind which usually forms in rainy season. Vessels may proceed to sea if barometer, state of sea, and weather are such as to lead masters and

pilots to infer that there is no danger. The wind at mouth of Húgli will probably haul from north-east through north to north-west, &c.

Day signal No. 8,
warning signal.



A ball below an inverted cone indicates probable passage northward and to the westward of Saugor island and north of False point, of a small cyclone, of kind which usually forms in rainy season. Wind at mouth of Húgli will probably veer from north-east through

east to south-east, consequently there will be heavy swell and strong westerly set in the channel at the Sandheads; it is advisable that only fast steamers in light trim should put to sea if weather appearances and state of sea, &c. admit of it.

Day signal No. 9,
danger signal.



A ball below a drum indicates the approach towards Saugor roads of a small cyclone, of kind which forms during the rainy season. Advisable that no vessel other than fast steamers in light trim should put to sea, until the state of weather and sea and rise of barometer

indicate that the storm has either broken up or passed inland. Cyclonic storms of small extent sometimes blow fiercely and raise a high sea near their centres.

3. At Night.—The following storm warning signals will be hoisted during the prevalence of cyclones in the bay of Bengal at the signalling stations on Saugor island, Mud point, and Diamond harbour, between sunset and sunrise :—

Night signal No. 1,
warning or
caution signal.



Three lights placed vertically indicate the existence of a cyclone in the north part of the bay of Bengal.

Night signal No. 2,
danger signal.



Two lights placed vertically indicate the early approach of a cyclone to the Bengal coast.

DIAMOND HARBOUR, off a creek of the same name on the left bank of the Húgli, about 42 miles above Saugor roads, affords anchorage for large vessels, but is seldom resorted to except by foreign vessels not wishing to ascend to Calcutta. An excellent road connects Diamond harbour with Calcutta, and here are a telegraph station and custom house. This is the third reporting station for passing vessels. A dawk boat boards passing vessels, and is generally furnished with the latest weather chart, railway time table, &c. The boat with a blue flag is for outward, and that with a red flag, for inward bound vessels.

Tides.—It is high water, full and change, in Diamond harbour at 11h. 45m. Springs rise $16\frac{1}{2}$ ft. and neaps $12\frac{1}{4}$ ft. above lowest low water of the dry season; neaps range $7\frac{1}{4}$ ft. During the summer freshets, the spring tides probably rise 3 to 4 feet higher.

CALCUTTA, situated on the left bank of the Húgli, about 83 miles from its mouth, originally the site of the three riverside hamlets of Sutanati, Kalikata, and Govindpur, is now the capital of India, and the chief centre of communication with all other parts of Hindustán. The population in February 1891, was 439,861. During the cool season Calcutta is the seat of Government in India.

The port of Calcutta extends for nearly 10 miles along the Húgli, and moorings are laid down for about 170 large vessels. The port rules are supplied to vessels on arrival.

TIME BALL at Fort William semaphore tower is dropped daily at 1h. p.m., Calcutta mean time, equivalent to 19h. 6m. 39·2s. Greenwich mean time. A time ball is simultaneously dropped at the Port Commissioner's office about $1\frac{1}{4}$ miles higher up the river. A flag is hoisted on the semaphore tower at 20 minutes before signal, and ball hoisted at 5 minutes before signal, at both places, as preparatory.

Calcutta reach extends from the Royal Mint to Kidderpur docks on the left, and from Howrah docks to Shalimar point on the right bank of the river, on a course of S. by W. $\frac{1}{2}$ W. off the Mint to S.W. by W. $\frac{1}{2}$ W. off Kidderpur, and for a distance of 2·6 miles. Below the Port Office the channel lies close along the Calcutta bank and contracts in width, from $2\frac{1}{2}$ cables above the Port Office to $1\frac{1}{4}$ cables abreast Fort point; it then widens to 3 cables abreast Kidderpur. There are 30 to 44 feet in the channel above the Port Office, and 45 to 60 feet below it as far as Garden reach.

Húgli bridge, crossing the river above the Howrah railway terminus, about 1,500 feet long, is a wooden structure floating on

pontoons of iron, and is opened for the passage of vessels twice a week, as advertised in the daily papers.

Fort point is well marked by a small kiosk with a dome, and has tall bushy trees around it. There are eddies off and below this point on the spring ebbs of the freshets.

Tolly Nullah is a navigable creek joining the river above Kidderpur. An iron girder bridge crosses it close to the river.

TIDES.—It is high water, full and change, at Calcutta at 2h. 0m. ; springs rise 17 feet ; neaps rise 12 feet and range 7 feet. Springs rise 4 feet higher from June to October, than they do from October to June. When regular, the flood stream runs for 5 hours, the ebb stream for 7 hours. During the north-east monsoon the streams run 3 to $3\frac{1}{2}$ knots at springs, and $1\frac{1}{2}$ to 2 knots at neaps. Between March and July the flood runs 4 to 6 knots at springs. During the freshets, July to October, the streams sometimes run 6 knots. The tides set fair up and down the reach.

Communication.—See page 16.

Shipping.—The port of Calcutta was entered in 1891 by 1,038 vessels, of 2,250,948 aggregate tonnage.

Imports and Exports.—In the year 1890–91 the value of the exports from Calcutta was Rs. 357,676,546, and of the imports Rs. 259,829,180. The principal exports are raw cotton, cotton twist and yarn, opium ; dyeing, colouring and tanning materials ; grain and pulse, hides and skins, jute, gunny bags, lac, oils, saltpetre, linseed, seeds, rape, silk, piece goods and tea. The principal imports are apparel, corals, cotton goods, tobacco, glassware, hardware and cutlery, machinery ; unmanufactured and manufactured copper, mixed metals, iron, lead, steel and tin ; vegetable and mineral oils, paints and colours, provisions, railway materials, pepper, sugar, shawls, wines, spirits and beer.

Hospital.—There is a hospital for seamen and a Sailors' home at Calcutta.

Docks.—There are eleven dry docks at Calcutta, the largest of which is the Port Commissioner's dock at Kidderpur, 710 feet in length, 60 feet breadth of entrance, and $23\frac{1}{2}$ feet depth on sill at high water ordinary springs. The other docks are less than 400 feet in length. For further details, see Dock Book. There are two wet docks at Kidderpur, entered through a tidal basin. The depth at entrance of No. 1 wet dock, is 32 feet at high water ordinary springs, and the width of entrance is 60 feet.

Repairs of any kind can be executed.

Coal.—Any amount of coal can be obtained. It is shipped either by lighters, or from wharves. Vessels of 25 feet draught can lie alongside the P. and O. Company's wharf in Garden reach ; and there are about 2,000 feet of jetty accommodation for vessels of 25 feet draught.

Supplies can be obtained in any quantity.

STORM SIGNALS used within the limits of the port of Calcutta give notice of the early approach of a severe cyclone with its attendant storm-wave. They are hoisted on the flag-staff upon the Port Commissioners' Office, on the yard-arm of Government Dock-yard flag-staff, Kidderpur, and on the flag-staff at Sibpur.

A *ball* (similar to Day Signal No. 1, page 196) indicates a severe cyclone, the centre near Saugor island, and will probably advance towards Calcutta.

A *drum* (similar to Day Signal No. 4, page 196) indicates a severe cyclone with storm-wave approaching Calcutta.

Two balls, placed vertically, indicate the existence of disturbed weather in the northern part of the bay of Bengal. The disturbed conditions may consist of squally weather with strong winds to the southward, which may shortly pass away, or which may be the first stage in the formation of a cyclonic storm.

Three lights placed vertically (similar to Night Signal No. 1, page 197) indicate a severe cyclone, the centre near Saugor island, and will probably advance towards Calcutta.

Two lights placed vertically (similar to Night Signal No. 2, page 197) indicate early approach of a severe cyclone and its storm-wave to the port of Calcutta.

Navigation.—Vessels going against the tide are to ease down or stop if likely to meet other vessels in dangerous parts of the river, such as on the James and Mary bar, or off Falta point in strong tides, or on the bars when there is only water enough in one or two tracks for the safe passage of vessels. The anchor light is always to be shown at the starboard foreyard arm when at anchor for the night. The Board of Trade rules of the road are adhered to for the navigation of the channels of the river and estuary. A prolonged blast of the steam whistle, followed by three short ones quickly, is an optional signal that a steamer has been obliged to stop, and cannot get out of the way.

Climate.—The following table is from observations taken at Calcutta, at an elevation of 21 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		Mean.	Cloud.	Ins.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	65	77	55	22	33	71	1·4	0·4	2	30·02	·13
February - -	70	82	61	21	37	69	2·2	1·0	3	29·95	·13
March - -	79	91	70	21	38	69	2·2	1·3	3	—·86	·14
April - -	85	96	76	20	33	71	2·8	2·3	5	—·75	·14
May - -	85	94	77	17	30	76	4·4	5·6	10	—·66	·12
June - -	84	91	79	12	25	84	7·0	11·8	18	—·55	·10
July - -	83	88	78	10	17	87	8·1	13·0	24	—·54	·09
August - -	82	87	78	9	16	89	8·2	13·9	24	—·60	·10
September - -	82	87	78	9	17	88	7·1	10·0	18	—·68	·11
October - -	80	87	75	12	23	83	4·2	5·4	8	—·83	·11
November - -	72	82	64	18	29	74	2·4	0·6	2	—·96	·12
December - -	65	76	56	20	31	72	2·0	0·3	1	30·02	·13

Húgli river tides.—The strong southerly winds, which prevail from March to September, force the water into the river, and help to raise its mean level 4 feet higher in August and September, its highest level, than in February and March, its lowest level. The northerly winds, which prevail from November to February, drive the water out of the river; and the amount of fresh water coming down the river from July to October tends to raise the level in those months. The tidal wave takes 5h. 8m. to travel from the Eastern channel light-vessel to Calcutta, its rate of progress being 44 miles an hour at that light-vessel, and 18 miles an hour at Calcutta.

Above Saugor the velocity of the flood in the dry season, on a perigee spring-tide, is about 4 knots. In the apogee springs its velocity is less. The ebbs of the dry season are not so strong as in the freshets, when for some days at neaps there is no flood stream felt above Diamond harbour, although there is the usual rise and fall. In the dry season there is a slight tidal rise as far as Nadiya, 78 miles above Calcutta.

Bore.—The bores in the Húgli occur only on the highest, or at alternate spring tides; their appearance may, with certainty, be predicted by the season of the year and the parallax of the moon. During the months of November, December, January, and February, or on the periodical ebb of the sea, when the currents are setting down the bay, the tides, as may be supposed, are languid, and consequently, during this period there are no bores.*

As soon as the south-west monsoon sets the currents up the Bay, the sea begins to rise, the tides become strong and high, and bores follow in their train; whenever the parallax of the moon is high on the springs during the south-west monsoon, bores will certainly make their appearance, and when strong southerly winds are added, and freshes withheld, the height of the bores will be increased. The first appearance of the bore is on the Diamond sand, where the ascending wave runs on as a breaking roller; but is not of much consequence until it enters the contracted reaches above James and Mary shoals, or Húgli point, when, besides swamping boats, it affects vessels at anchor, by causing them to run up-stream, more especially if there be a strong southerly breeze. The vessels at moorings surge and roll during the passage of the bore, as there is a sudden lift of 4 to 6 feet; and when bores are expected, vessels have to put springs on their flood moorings close down to the buoys, the weight of the vessel being held by them instead of by the cable moorings.

During the freshets anchors are speedily buried up by the silt, so that sometimes it is necessary to slip the cable and leave the picking up of the anchor to the hoy, owned by the Port Trust of Calcutta.

THE SUNDARBANS† form the southern portion of the delta of the Ganges, and extend along the sea face of the north part of the bay of Bengal from the estuary of the Húgli to that of the Meghna, or from about long. $88^{\circ} 4'$ to long. $91^{\circ} 14' E$. Their extreme

* Except very rarely—in twenty-two years—I (Mr. Kyd) have known but three instances. Agreeably to the statement of local causes which accelerate or depress the tides, it will be obvious that, during the north-east monsoon, if the winds which blow the waters down the bay be more than usually moderate, and the moon's parallax be high, there may a high tide, and with it a bore, and this, in consequence of the rule of inequality of height with regard to the monsoon, will happen at night. These night bores are particularly dangerous, as they are very rare, and consequently unexpected. They may be guarded against by always considering it possible for them to occur during the north-east monsoon at night, upon a high parallax of the moon. Agreeably to the same local cause, it is fortunate that the bores at night, during the south-west monsoon are not so high as in the day.—[The preceding remarks are extracted from an article in "Asiatic Researches," Vol. 18, page 266, published in Calcutta, 1833.]

† Said to take their name from the Sundri tree, which yields a hard wood used for building boats and furniture, and is common throughout the forests of the Sundarbans.

length along the coast is about 165 miles, and their greatest breadth from north to south about 80 miles. The west and east portions of the Sundarbans lie high when compared with the central part, towards which the ground gradually slopes, and which is low and swampy. In the western part, the water of the streams is for the most part salt, and the cultivated lands are surrounded by high embankments with scattered clusters of huts. In the central part there are no habitations, the water is not salt, and the embankments, which surround the fields on or near which the cultivators do not live, are lower. In the eastern part, the land being high, and the river water almost fresh, embankments are not necessary; the soil too is richer, and the peasant generally has his granaries surrounded by a grove of trees.

The inlying tracts are to a great extent protected from the effects of storm waves by the belt of thick jungle near the sea. Wild animals are numerous, and snakes, as well as many birds, abound.

The chief place amongst the Sundarbans is Khulna in Jessor, about 65 miles eastward of Calcutta, at the junction of the Atharabanka and Bhairab rivers, towards which boats can be tracked through the Calcutta canals. From Khulna routes branch off north, east, and south.

In 1876–77 the timber and firewood imported into Calcutta from the Sundarbans was valued at 590,000*l*. Other products are canes, reeds, honey, beeswax, and shell lime. Large quantities of fish are caught and sent to Calcutta.

HOUSES OF REFUGE for castaways wrecked on the sea face of the Sundarbans have been erected in the following places :—

No.	Situation.	Peculiarity.
1	On Seyer point, 13 miles E.S.E. of Saugor lighthouse.	On grassy plain east of some high sand hills. Painted red.
2	On east side of, and three miles within the entrance to Sattarmukhi river and 10 miles north-east of House No. 1.	In thick jungle, 200 yards above high water mark. Painted white.
3	On west side of Balchhari island and east side of Jamira river.	Distant 200 yards from high-water mark. Painted black.
4	On S.E. side of Dalhousie island and 4 miles east of entrance to Mutlah river.	On a sandy patch. Painted white. Close to is a spar and bamboo with white flag, visible above the trees.
5	On southern part of Bangaduni island, west side of Guasuba river, and 6 miles eastward of House No. 4.	Above a small sand beach, and 100 feet from high-water mark. Painted white. Near it is a white spar and bamboo with white flag.

Provisions, water, and stores are placed in each refuge house. The stores are sometimes robbed, so take enough provision if moving from one refuge house to another. No one should stray, tigers are numerous. Make a fire with drift wood. After gales a steamer visits the refuge houses. Unless you have boats await her arrival. In ordinary weather send notice to Mud point, Saugor island, or port Canning, or to vessels entering, by boat or catamaran provided. Chart indicates route. Follow the large creeks or sea beach from one house to another until you come to Channel creek (if going west); there are villages on Saugor island, visible from refuge house No. 1. To the east, villages will be found above the Kattali, on the river Mutlah, if proceeding to Canning Town.

Break branches of trees, (allowing them to hang), if travelling north, on the north side of the trees; if west, on the west side. Do this at points and creek entrances. Carry fire; make signal-fires at stopping-places. The rope is for making a raft or for tracking. Drift wood is often found sufficient for a raft. The hearts of young palm trees are edible; scurvy grass also when cooked. Water can be procured at No. 1 house by digging on the higher part of the land, and in many parts at short distances from the sea, on the higher lands. The hose is to assist to save water when it rains, and to refill tank before leaving the house.

For positions of these refuge houses, *see* Admiralty chart:—The Sandheads, &c., No. 814.

THE COAST eastward of Saugor island continues in a series of low, alluvial, jungle grown islands, having sands projecting from them to the southward or seaward, intersected by numerous creeks and rivers, for details of which the chart is the best guide.

Lacam's channel, leading to Channel creek, called by the natives Barratulla, which runs up eastward of Saugor island, indicates the opening or entrance to the Húgli between Saugor and Sattarmukhi sands. Lacam's channel appears subdivided by a detached bank of $1\frac{1}{2}$ fathoms on its western side, and by a spit extending southward from the west side of Sattarmukhi sand, admitting however a channel about 2 miles in width, and safe passage into Channel creek, when aided by local knowledge.

Sattarmukhi river, the entrance to which is between a sand of the same name and another termed Balchhari, splits into two branches abreast Balchhari island, the eastern of which is termed the Jamira river. Neither are visited by sea-going vessels.

MUTLAH (MATLĀ) RIVER* (Raimatla), is the name given to the united streams of the Bidyadhari, Karatoya, and Atharabanka which flow southward through the Sundarbans into the bay of Bengal. The mouth of the Mutlah, about 27 miles east of Saugor island, is separated from the Jamira river by Balchhari island and flats. A light vesse indicates the position of the approach to the river, the southern extremity of the land on the eastern side of the entrance, being in about lat. $21^{\circ} 32' N$. The Mutlah has several branches at its mouth, one of which extends to the salt water lake near Calcutta. The greater number of the buoys placed in 1857 to mark the channel were afterwards removed, and sea-going vessels seldom enter the river.

NOTE.—The shoals at the entrance of the river are liable to change, and the following information must be used with caution. There are no pilots for Mutlah river.

MUTLAH LIGHT VESSEL, off the entrance to the Mutlah river, affords an excellent mark for vessels approaching the Húgli from the south-east. The light vessel is moored in $11\frac{1}{2}$ fathoms at low water, about 30 miles from the nearest land and with the station buoy bearing North, distant one mile; or in about lat. $21^{\circ} 2' N$, long. $88^{\circ} 45' E$. She is painted red, and carries a black ball on each of the fore and main mast heads, and *Mutlah* is painted in white on the vessel's side. At night, at a height of 44 feet above the water, a *double flashing white* light, showing *two flashes every thirty seconds* is exhibited; the duration of each flash being *about two and a half seconds*; of the intermediate eclipse, *about two and a half seconds*; and of the long eclipse, *about twenty-two and a half seconds*; visible 12 miles in clear weather. An ordinary riding light is carried on the forestay 6 feet above the vessel's rail.

PORT CANNING, about 60 miles from the mouth of the Mutlah, and formerly a municipality, was started by an English company to supply an auxiliary harbour to Calcutta, with which town it is connected by rail. The attempt failed, and trade has clung to the Húgli.

Canning Town in 1884 was in a dilapidated condition; the brick buildings exclusive of railway station, cutchery, and rice mills had gone to ruin. The bazár was neglected, and no water fit to drink

* See Admiralty chart of Mutlah river No. 82; scale, $m = 1.3$ inches.

was obtainable, the large tanks being impregnated with salt. There were about 700 huts.* The foreshore from Canning station to the rice mills, in the Bidyadhari river, was washing away. A tramway which encircles the locality of the intended town was out of repair. The five jetties were worn-out, the boat dock overgrown with scrub, the dock gates and walls having fallen into the river. To the eastward of the entrance to the boat dock a large well-built sluice was in fair repair. The rice mills were working. A train runs daily to Canning and back from Sialdah station. Between Canning and Edu reach there are native villages sprinkled about the clearance. The land below Edu reach to the sea, is dense jungle, with undulations at intervals, as if parts had sunk. At high-water spring tides, below the Kattali, the water runs some distance inland. The country is infested with tigers, pigs, and deer.

Western or Ward Channel is bounded by Balchari sand to the westward, and Raimatla sand to the eastward. The least water in this channel is about 4 fathoms westward of the northern end of Raimatla sand, where the channel is little more than a mile in width.

Eastern Channel lies between Raimatla and Dalhousie sands, with about 5 fathoms least water, abreast the north end of Raimatla sand. The shoal southward of Dalhousie point contracts this channel considerably in that vicinity.

REMARKS.†—The chief drawback to the navigation of the river is that between Dalhousie point and the Mutlah light-vessel, the soundings are so regular that the lead is no guide in bad or thick weather as to which side of the channel a vessel is on. The edges of the sands are so steep as to render borrowing on them dangerous. Inside the river the same conditions obtain.

The entrance of the Mutlah river is not so difficult as the Húgli. The Raimatla is a narrow bank, the northern part nearly drying, extending N.W. by W. and S.E. by S. for 12 miles, and situated between the Balchari and Dalhousie sands. From the north extreme, Westspit, marked in 1885 by two weather-worn buoys, extends 4 or 5 miles S. by W. with depths of from 14 to 22 feet. Western channel is preferable to the eastern channel. The eastern edge of Balchari sand may be followed up with the lead until Dalhousie point can be

* Abridged from a report by Nav. Lieut. E. W. Petley, R.N., Dep. Conservator of the Húgli river approaches, who re-surveyed the Mutlah river in 1884.

† Commander A. Carpenter, R.N., 1885; and Nav. Lieut. E. W. Petley, R.N., 1884.

recognised at a distance of about 10 miles from a height of 24 feet. The western clump of trees on Dalhousie point appears double and larger than the rest ; when this bears N. by W. $\frac{3}{4}$ W. steer for it, allowing for tide, so as to edge off Balchari sand, which gets steep-to and shoal, and keep in mid-channel. Halliday island will now soon be sighted, and the eastern extreme should be steered for. On nearing Dalhousie point it shows a high white sandy beach, conspicuous when the sun is out. No. 4 Refuge house is visible from W.S.W. with a pole and cage over it, but shuts in from further north.

Tides.—Abstract of Mutlah river tidal observations :—

STATIONS.	High-water Full and Change.	Above Lowest Low-water of Dry Season.		Neaps Range.
		Springs Rise.	Neaps Rise.	
Mutlah light-vessel -	h. m. IX. 43	ft. in. 9 4	ft. in. 6 8	ft. in. 3 4
Halliday island -	X. 12	10 0	7 6	5 0
Kattali (Bidda point)-	X. 45	14 8	12 0	7 0
Port Canning -	XII. 5	17 3	13 2	8 0

The tidal streams below Dalhousie appear to rotate in the same way as they do near the Húgli, viz., the first of the flood to W.N.W., working round to E.N.E. ; the first of the ebb commencing at E.S.E. working round to W.S.W., and the strength of the tides is similar to those of the Húgli. The flood runs direct up channel, tending towards the eastern shore until abreast Dalhousie river, when it crosses south of Grappler shoal towards Peel point, forming eddies ; it then runs up abreast of Rodger point, where it bifurcates, the greater portion running up Bidda river, and the rest round Rodger point into Kattali bight, leaving slack water in the vicinity of Bidda point.

The strength of the flood tide varies in different parts of the river, but the maximum rate recorded was 5 knots an hour.

The ebb tide inside the Mutlah river sets fairly down the channels until off Rodger point, where it forms considerable eddies ; it then runs along Peel island, and down the channel until last quarter ebb, when the direction of the tide is S.W. from about abreast of Dalhousie point, across the river towards Halliday island. The maximum strength of ebb tide recorded was from one to $2\frac{1}{2}$ knots per hour. The maximum rise of tide at port Canning was 18 feet 4 inches.

Bangaduni River, about 5 miles eastward of the Mutlah river, is small with tolerably deep water at its mouth, through which the course to seaward is about S.E. It takes its name from Bangaduni island, which forms its east side of entrance, and northward of which is a narrow channel carrying from $2\frac{3}{4}$ to 8 fathoms.

Guasuba River, about 5 miles eastward of Bangaduni river, is of considerable size, but difficult to enter on account of the bending channel at its mouth, which is probably subject to change.

Raimangal River, about 12 miles eastward of Guasuba river, receives, about 6 miles from the sea, the streams of the Hariabhanga on its western side, and the Jamuna on its eastern. This is one of the most considerable openings on the coast, and the channel leading to it appears to have $3\frac{1}{2}$ fathoms in its outer or southern part, in about lat. $21^{\circ} 23'$ N., long. $89^{\circ} 15'$ E., between the entrance banks; but without local knowledge it should be avoided, unless in case of necessity, when the chart will be found the best guide.

Malancha River has its entrance about 7 miles eastward of Raimangal river. The channel leading into it from the southward has depths of 3 to 4 fathoms, is narrow, and takes the direction of about North and South.

Bara Panga River has its entrance about 5 miles eastward of Malancha river, divided from it by Putni island, from which island flats extend to the south and south-east for about 11 miles.

Marjata or Kaga River entrance is about 9 miles eastward of Putni island, and appears curved and complicated, with a depth at low water of about $3\frac{1}{2}$ fathoms. About 5 miles inside or northward of the river entrance, are two low islets termed Pavanga, on the southern of which there was formerly said to have been a tank of fresh water.

At about 20 miles south of the entrance to the Marjata river is the north end of the depression, known as the Swatch of No Ground.

Bangara River entrance is about 13 miles eastward of that of Marjata. The Bangara, which is small, takes a south-easterly course near its mouth, which is separated from that of Marjata by another small river. All three rivers communicate with each other.

Argo flat is the name given to the extensive shoal ground which extends off the mouths of Bangara and Haringháta rivers, and stretches to the south or seaward for about 15 miles. The Argo flat shows dry sand banks in parts, and heavy breakers have been observed on it as

far as 8 miles S. by E. of Tiger point, on the west side of entrance to Haringhata river.

Swatch of No Ground,* a remarkable depression in the coast bank of soundings, is from 6 to 12 miles in breadth. The north part is in about lat. $21^{\circ} 24'$ N., long. $89^{\circ} 34'$ E. From the depth of 20 fathoms near the north limit, it suddenly drops to 125 fathoms, and at about 30 miles S.S.W. of this there are depths upwards of 400 fathoms. Nothing is known of the southern depth or limit.

HARINGHÁTA RIVER, signifying "Deer ford," 70 miles east of the Mutlah river, is a deep estuary about 7 miles broad at its mouth, by which the southern part of the Baleswar river, one of the principal distributaries of the Ganges, enters the sea. The river is navigable as high as Morrellganj by seagoing ships, and throughout its entire course by the largest native boats. Navigation is said to be easier than that of any other river at the head of the bay of Bengal, nor is the river disturbed by the bore, which visits the Húgli and Meghna. It is also free from mid-channel dangers. The bar which stretches across the mouth of the Haringhata has over it 15 feet at low water. The river and its tributaries pass through a tract of fertile country. Vessels that formerly frequented the river did so during the north-east monsoon. A heavy sea prevails at the entrance during the south-west monsoon, and it cannot at that time be recommended—in any case a pilot is necessary.

Morellganj, about 35 miles up the Haringhata, in lat. $22^{\circ} 27'$ N., converted from jungle into a prosperous rice growing tract by Messrs. Morell and Lightfoot, was declared a port by the government of Bengal in November 1869, and the sands at the approach to the Haringhata river were buoyed, and beacons placed on each side of the entrance, or at Tiger and Deer points; but all (it is believed) have since disappeared, and the future of the port is now uncertain.†

* See Admiralty chart, Mutlah river to Elephant point, No. 859.

† Sounded the whole of the way down, and found ample water, as well as room, inside the bar. My opinion is that it is eligible for traffic by a draught of 22 feet, during the cold season, with steam to get in; and for small vessels at all seasons with steam to get out during the south-west monsoon. I see no greater difficulty in a small vessel working out in the latter season than a large vessel working out from Saugor. There is no such danger as the James and Mary, and the river being comparatively straight, the greatest swerve being from N.N.W. to N.N.E. in a distance of about 5 miles, a handy vessel can work up the whole way to within $2\frac{1}{2}$ or 3 miles of Morrellganj, from which place a vessel can drop or tow.—(Remarks of Thomas McNabb, master of ship *Lady Egidia*, December 1870.)

Tides.—It is high water, full and change, some 35 miles south of the entrance to the Haringhata river at 10h. Springs rise 9 feet. At Tiger point at 11h. The tidal stream is reported to run more than 4 knots at springs.

Rabnabad Island, at the mouth of the channel of the same name, about 18 miles eastward of the Haringhata river, is about 14 miles in length and $2\frac{1}{2}$ in breadth. The Rabnabad channel westward of it is narrow, with a depth in the northern part at low water of $2\frac{1}{4}$ fathoms. After bending to the south-east round the north point of Rabnabad island, this channel by means of the Kajul and Tetulia river, of which latter little is known, connects with the river Ganges.

Barisál, on the left bank of a river of the same name, connected with the Ganges, is situated in about lat. $22^{\circ} 42' N.$, long. $90^{\circ} 22' E.$, and has a population of about 8,000. The trade, in which the exports greatly exceed the imports, is carried on at river-side markets, regular communication taking place entirely by water. Barisál is the capital of Bakarganj district, the area of which is 4,066 square miles, and population 1,874,201, and which extends to the sea face of the Sundarbans westward of the island of Dakshin Shahbazpur. The Tetulia river, which appears to afford the nearest route to Barisál from seaward, is from 2 to 3 miles in width, but has not been surveyed.

MEGHNA FLATS, extend many miles south-westward of the Shahbazpur entrance to the Meghna river; and at present they are not apparently growing. The southern extreme of these flats is in lat. $21^{\circ} 24' N.$, long. $90^{\circ} 18' E.$

D'Apres shoal is a sand bank which dries at low water, near the southern termination of one of the banks formed by the deposit brought down by the Meghna. It is situated in about lat. $22^{\circ} 0' N.$, long. $91^{\circ} 7' E.$, or about 18 miles southward of the dry land entrance points of the Shahbazpur river.

A shoal with a depth of 15 to 18 feet over it, lies in lat. $21^{\circ} 58' N.$, long. $91^{\circ} 26' 30'' E.$ *

BRAHMAPUTRA RIVER,† known to the Assamese as the Haraniya, has an estimated length of about 1,800 miles, the great bulk of its waters flowing to the south-west, and reaching the sea

* This is probably the shoal reported by the port officer of Chittagong in 1882, as situated in lat. $21^{\circ} 55' 4'' N.$, long. $91^{\circ} 22' 30'' E.$

† The term Brahmaputra (the son of Brahma) is the Hindu name of that section which waters the valley of Assam.

by the broad estuary known as the Meghna. The actual course before reaching British territory has not been satisfactorily determined, but the main stream of the river is made up by the confluence of the Dibang, Dihang, and Brahmaputra proper, in about lat. $27^{\circ} 50' N.$, long. $95^{\circ} 50' E.$

In agricultural and commercial utility the Brahmaputra ranks next after the Ganges and the Indus among the rivers of India, although no large towns are situated on its banks. It is navigable by river steamers as high up as Dibrugarh, about 800 miles from the sea, but the current is so strong in places, that vessels are sometimes unable to make headway and have to stop for days.

Sirajganj in the Bengal district of Pabna is the largest emporium on the banks of the Brahmaputra. Here all the produce of the surrounding country is collected for transmission to Calcutta. The downward trade consists chiefly of tea, timber, oil seeds, caoutchouc, and raw cotton from Assam; and jute, oil seeds, tobacco, rice, and grain from Eastern Bengal.

The imports up stream are European cotton goods, salt, and hardware to Sirajganj; and rice, tea seed, liquors, &c. for Assam. The I.G.S.N. Company run steamers from Calcutta to Dibrugarh all the year through, the time occupied varying from 20 to 25 days. In 1876-77 the value of the tea alone, brought down the Brahmaputra from Assam, was $1\frac{1}{2}$ millions sterling.

Sandwíp (Sundeeep) Island about 14 miles long, north and south, by 9 miles in width, is the largest of the islands or chars, formed by the Meghna river as it enters the sea. Eastward and northward of it, is the channel by which the Meghna is entered. The island is low and fertile, and said to be free from tigers and other beasts of prey. The principal village is on the eastern side. The cocoa-nut palm flourishes, and sugar cane is cultivated to a great extent. The tide rises 15 to 18 feet. From its low-lying position the island is peculiarly exposed to inundation from storm waves, suffering severely in this respect from the cyclones of May 1864 and October 1876.

MEGHNA RIVER* conveys to the sea the main volume of the waters of both the Ganges and Brahmaputra. It runs south throughout its course, forming a boundary between the two halves of Eastern Bengal, and enters the sea by four principal mouths enclosing the three islands of Dakshin Shahbazpur, Hatiá, and Sandwíp. For

* The name Meghna is properly applied only to the channel of the old Brahmaputra, from Bhairab bazar downwards.

some years the Meghna has shown a tendency to shift its channel gradually to the westward. Near Noakhali the mainland is said to have advanced seaward 4 miles in 23 years.

Navigation is practicable as far as Narainganj (about 160 miles), for steam vessels drawing 15 feet, but at the same time dangerous between the months of February and November, when at spring tides a heavy bore is experienced in the lower parts of the river. Sailing vessels will find the passage tedious, although many native brigs drawing 10 to 12 feet, and even Chinese junks make the passage, working almost entirely by the tide.

The eastern or Sandwíp channel leading into the Meghna is that generally recognised as the navigable entrance. There is a distance of about 70 miles with shoal water, and four bars to be crossed. A steam vessel leaving Sandwíp anchorage with first quarter flood could accomplish the distance in one tide; but the whole distance to Narainganj is 160 miles, and by attention to tide this can be managed in two working days. The worst parts are, (1) the north portion of Sandwíp channel as far as Noakhali point; (2) the crossing at Narnak char as far as the Ilsa river; (3) off the mouth of the Padma river between the chars above Chandpur; (4) the mouth of the Lakhmia river.

Native pilots who are regularly employed in the coasting trade can be obtained at Chittagong. The aid of the local pilots or boatmen is essential in the more difficult parts of this navigation.

DIRECTIONS.*—The channels and sands frequently change, therefore the following directions must be considered approximate only, and are applicable for the dry season, or November to February. During the rains there is more water, and greater, but more dangerous tidal influence. Vessels proceeding up the Meghna to Narainganj should obtain a pilot at the mouth of Chittagong river, thence steer up along the coast about N.W. by N. for about 25 miles, and if the tide is falling or the day far advanced, anchor in 4 fathoms at low water, with Sitakund hill bearing N.E. by E., north extreme of Sandwíp island W.N.W., and the east entrance point of Feni river N. by W. Weighing from this anchorage with first quarter flood the channel used leads about $1\frac{1}{4}$ miles distant from the north-east side of Bidu island, across to the village of Chiringa allowing for a strong

* Chiefly from a report by H. B. Simpson, Esq., Marine Survey of India. printed in "Calcutta Government Gazette" of June 20th, 1883.

set into the Feni river, and close along the south side of a new char formed on the north side of the river, the course steered being about W.N.W.

Bidu bar has about 4 feet at low water, with a rise of from 16 to 18 feet at springs, which run 5 to 6 knots. Native craft only work on the neap tides during the rains, as anchors will not hold in the ebb, at springs.

Sidi bar between the island of Bidu and Chiringa village is the second bar to be crossed in the ascent, and has a depth of about 7 feet with a rise of 14 feet; if there is insufficient flood to carry a vessel across, anchor in about 5 fathoms, abreast the nullah that separates Bidu and Sidi islands. The shoals northward of Sidi undergo frequent changes; it is therefore necessary to obtain the services of local boatmen, and the passage towards Chiringa on the Noakhali shore should be taken towards high water. The banks here on both sides are constantly being cut away by the stream, the loud noise of the mud falling, being heard at short intervals, especially at night. The bank at Chiringa is steep, with deep water close in, and native vessels lie at anchor here in 6 fathoms, out of the strength of the tide. From Chiringa, to Noakhali point, the channel lies close to the north bank of grass land, in a S.W. by W. direction with a breadth of 4 cables at low water.

Noakhali bar.—A single tree stands near Noakhali point, off which is another bar having 12 feet over it, with a rise of tide of 10 feet; here the river turns to the north-west.

Noakhali Point to Narnak Char.—The channel lies close to the east bank with good depth, about 5 cables wide, as far as two palm trees, bearing from the north point of Narnak char N. 72° E., towards which it crosses, with a low water depth of 16 and a rise of about 9 feet at springs. The stream is not so strong here as in the Sandwip channel, and at ebb tide, neaps, the water was fresh. Two new chars, have formed in the lower part of this reach. The east bank is grass-land close to the river, some distance in, clumps of trees grow, and a mosque is visible at intervals; its position being in about lat. 22° 46' N., long. 91° 0' E., 2 miles from the bank.

Above Narnak Char (Lallan char) the channel has 20 feet for 9 miles, in a N. by W. $\frac{1}{2}$ W. direction, and lies near the middle of the river towards the west bank; abreast of and beyond Ilsa river, as far as the mouth of Padma river, there is good water, the channel lying close to the west bank. The river trends to the north-west from the mouth of the Ilsa to the Nowa Bhangri, then

north to the mouth of the Padma. Beyond Abudu point on the eastern side, a sand extends from the bank to nearly the middle of the river. The west bank is covered with thick jungle from Shahbazpur river to within a mile of the mouth of the Padma.

Off the Padma, the mouth of which is ill-defined, about 18 feet is found. From this, to the first char above Chandpur, there is deep water; running out from these chars are shoals with channels between.

The direction of the river is N.E. by E.; then N. and W.N.W. to Rajbari temple. Above the last char the channel is wide and deep, direction about north, as far as the mouth of Daudkandi river, where it again shoals to 22 feet. After passing the last char above Chandpur, Rajbari temple comes in sight on the west bank; it is situated 4 miles from the river, and is a conspicuous mark. The west bank is almost without jungle from the mouth of the Padma, and numerous villages are seen. The east bank is covered with jungle, from a short distance below Chandpur.

From the mouth of Daudkandi river, the eastern channel is deep as far as the mouth of Lakhmia river, a branch of the Dhaleswari, where there is a bar with about 18 feet and a rise of 2 feet. The western of the two channels formed by a char about 2 miles in extent, has a depth of about 17 feet at the upper bar, which is the shoalest. Above this the Dhaleswari river, by which Narainganj is reached, leaves the Meghna. Off the town of Narainganj, the river is deep on the west side (next the town), with a breadth of $1\frac{1}{2}$ cables.

Tides.—It is high water, full and change, at the anchorage off Sandwíp, at about 2h.; springs rise 18 and neaps 15 feet. Above Sandwíp add one hour for every 20 miles as far as Ilsa river. At Narainganj, high water full and change, is at about 11h. 30m., and the rise and fall 2 feet 6 inches.

The Bore* in the outer channels of the Meghna is very strong for four days at spring tides, and its influence is felt to a little beyond the Ilsa river or about 50 miles below Narainganj. Rushing with violence as a high crested wave, the Sandwíp channel bore meets another passing up between Hatia and Sandwíp islands, off the

* At the time of the equinoxes, especially with a south wind, the bore attains its greatest development. The tidal wave is seen advancing like a wall topped with foam nearly 20 feet high, at the rate of 15 miles an hour. In a few minutes all is over and the tide has changed from ebb to flow. In May 1867, Hatia island was submerged by the storm wave of a cyclone, and in October, 1876, three successive cyclone storm waves inundated Hatia and Sandwíp islands, height of wave being about 40 feet; 40,000 lives were lost.

north-west end of Sidi, forming a dangerous whirl. Between the months of November and February the bore is lighter and not considered dangerous.

Narainganj on the west bank of the Lakhmia in about lat. $23^{\circ} 37' N.$, long. $90^{\circ} 32' E.$, extends for about 3 miles along the river, and has inland steam communication with Calcutta, with the railway station at Goalanda, the Assam valley, and tea districts of Silhet and Cachar. The steamers tow large flats loaded with cargo especially for Calcutta. Considerable trade by native craft is also carried on with Chittagong. Country produce particularly jute is here collected and transhipped, and piece goods, salt, and European wares distributed. In 1876–77 the value of trade passing through Narainganj amounted to two millions sterling, this figure however sometimes including exports and imports twice over. There are several mills and steam jute presses. The bulk of the trade is in the hands of native merchants. Daily postal communication takes place with Calcutta.

SHAHBAZPUR RIVER leaves the Meghna immediately above Narnak char, and flows between Falcon char, Hatia, and Dakshin Shahbazpur islands. A bar is found close to the entrance at the north side of Falcon char, with about 14 feet and a rise of 9 feet. Beyond this is deep water as far as Shahbazpur point, below which is another bar with 14 feet, and a rise of 12 to 14 feet. **These two bars are the shoalest parts of the river.**

The passage through Hatia island, said to be used by the native brigs, does not seem to be now known by them, and is only used by row boats carrying passengers from the surrounding districts to Chittagong. The river banks in it appear to be very much cut away by the stream, and it probably has a considerable rise and fall, and a good depth at high water.

The land has altered considerably where the Shahbazpur river leaves the Meghna since 1841, the date of Captain Lloyd's chart, but is much the same as the revenue survey map of 1865.

Tides.—Off the elbow of the Meghna flats in long. $90^{\circ} 20' E.$ it is high water full and change at 9h. 30m. On the eastern edge of the flats, shortly before high water, an under current, warmer than the surface water, was found to set N.E. and E. In depths of 5 fathoms and under, there is always a swell for the first half hour of the flood stream.

It is high water, full and change, near the D'Apres shoal, at the entrance of the Shahbazpur river, at 1h. 30m. Springs rise 9 to 10 feet. Velocity of stream, about 4 knots.

It is high water, full and change, at Kutabdia island at 12 hours, springs rise 15 feet, neaps $9\frac{1}{2}$ feet. At South patches, springs rise 12 feet. The flood stream runs N. by E. and N.E. for one hour after high water. The ebb stream continues to run to S.S.W. and S.W. for $1\frac{1}{2}$ hours after low water at the place; the rate of the ebb at springs has been variously estimated at from 4 to 6 knots per hour; at neaps, about $2\frac{1}{2}$ knots. At springs the streams run northward and southward; but at neaps the set becomes circular, moving round with the hands of a watch. During the fine season the westerly stream continues for a longer period than the easterly.

APPROACHING CHITTAGONG.—Whatever the state of the weather or time of the year, but more especially during the south-west monsoon, or from April to September, the greatest care is necessary in making the mouth of the Chittagong (Karnafuli) river. The tides within 15 miles of this part of the bay of Bengal set up and down, or in line with the trend of the land, and at springs run 5 and 6 knots an hour. Vessels have been known, in hazy weather, to have been swept past Chittagong by the flood tide, and set upon the sands westward of Sandwíp island, without sighting either Kutabdia island light by night, or the land by day. Endeavour should be made, in nearing the land, if from the southward, to obtain soundings in lat. $21^{\circ} 10' N.$, long. $91^{\circ} 10' E.$ in 10 fathoms, soft mud. Even if the weather be favourable, and a vessel confident as to astronomical position, strict attention to the depth, as well as to the course and distance made over the ground, by making use of the ground log, will be advisable, and the water should not be shoaled under 7 fathoms.

The entrance of Chittagong river is N.N.E. $\frac{1}{4}$ E. 70 miles from the position given above. If possible the land should be made in the daytime, on account of off-lying dangers, consisting of Dolphin shoal and North and South patches, the vicinity of which is not indicated by the soundings; also on account of Kutabdia light being sometimes shrouded by fog and mist. If in doubt as to position, and the ground log denotes a strong flood tide, it will be well to anchor, to avoid being set to the northward on to the tails of the shoals extending from the south end of Sandwíp island and the entrance to the Meghna river, which are said to extend further south than the chart indicates.*

* In July 1891, a dangerous sunken wreck was reported to be lying about 23 miles westward of Kutabdia lighthouse, or in lat $21^{\circ} 52\frac{1}{2}' N.$, long. $90^{\circ} 25' E.$

During the south-west monsoon, approaching from the south-west, if cloudy weather has prevented observations being obtained, it would be well to sight the white cliffs about Cox Bazar, 48 miles southward of the entrance to Chittagong river, and then keeping westward of Red Crab island, shape course between the North and South patches, and outside the Kutabdia banks keeping the lead constantly going.

KUTABDIA ISLAND, the westernmost land fallen in with when approaching Chittagong, is 12 miles long north and south, by from 4 to 2 miles in width, low and level, covered with trees, and distinguishable at the distance of 7 or 8 miles; Kutabdia is protected by artificial embankments from the encroachment of the sea.

LIGHT.*—Near the north-western extreme of Kutabdia island, is a masonry tower, 111 feet in height, from which is exhibited a *flashing white* light with an eclipse of *one minute* between the flashes, it is elevated 121 feet above high water, and visible in clear weather from a distance of 17 miles. The light tower has its lower story coloured gray, and the upper part in alternate red and white horizontal bands.

SOUTH PATCHES, 13 miles from the nearest land, and 15 miles south-westward of the south point of Kutabdia island, consist of three heads of hard sand extending in a north and south direction; the northern and middle of these heads, having respectively 7 feet and 3 fathoms over them, are connected with one another, and are about $1\frac{3}{4}$ miles apart. The third or southernmost head has over it $4\frac{3}{4}$ fathoms at low water, and is $2\frac{1}{2}$ miles distant from the middle head. In fine weather, rollers may generally be seen near the South patches, and in a fresh breeze the shoaler parts have breakers upon them. Around the South patches, will be found depths of 9 and 10 fathoms, mud.

Buoys.—A whistle buoy, conical, of iron, and painted red, is moored in 10 fathoms at low water, a quarter of a mile West of the northern head or shoalest part of the South patches. This buoy can be seen from a height of 20 feet at a distance of 4 miles, and with a moderate sea the sound of the whistle has been reported audible at the same distance. It is liable to be washed away.

* The above light would be exhibited on 1st January 1893. Until that date a *fixed white* light, visible 12 miles, will be shown from Kutabdia island lighthouse, and a blue light will be burnt every quarter of an hour between 7 p.m. and 5 a.m. from 1st August to 31st December.

A spar buoy, with spire and cage, is moored about a mile westward of the middle head of South patches. The spar is painted black, and can be seen from about 2 miles off.

North patches stretch 12 miles in a north and south direction, extending southward in a broken tongue for that distance from a position about 3 miles westward of the south point of Kutabdia island. The depth of water on North patches varies from 4 feet to $2\frac{3}{4}$ fathoms, hard sand.

A channel about three-quarters of a mile wide, having from 9 to 16 fathoms of water, runs up inside North patches, or between these dangers and the sands extending off the south end of Kutabdia and westward from Maskhal island. The tide rushes with great velocity through this channel, and without local knowledge it is better not to attempt it.

Dolphin shoal nearly 4 miles westward of Kutabdia lighthouse, is about 2 miles long north and south, by half a mile in width, and has over it a depth of three-quarters of a fathom at low water. Between Dolphin shoal and the west side of Kutabdia island, the channel is 3 miles wide, and carries depths of from 6 to 7 fathoms.

A Buoy, painted white, with the letter *D* in black on it, and surmounted by a spire and ball, both black, is moored in 5 fathoms at low water off the west side of Dolphin shoal.

Anchorage.—There is anchorage in 7 fathoms with Kutabdia light bearing E.N.E. distant about **one mile**. Vessels may safely approach at night by steering with the light bearing E.N.E.; this leads over a narrow ridge of $4\frac{1}{4}$ to 6 fathoms S.S.W. of Dolphin shoal, but the lead may easily miss it. The anchorage is fairly protected, but the current runs quite as strongly as outside the shoals.

Sangu river the entrance of which, though almost filled up with sand banks at low water, appears, when these banks are covered, to be about 3 miles wide, enters the sea 13 miles northward of Kutabdia island lighthouse, the coast between being low and without distinguishing marks. The Sangu is navigable by large cargo boats for 13 miles from its mouth throughout the year, and connects higher up with the Karnafuli by a partly artificial channel.

Norman point.—The north entrance point of Sangu river, is broad and flat, fringed with extensive sand flats, and trending gradually to a bearing of N. by W. and North, forms the eastern bank of entrance to the Chittagong river. Norman point, about 6 miles northward of the entrance of the Sangu, terminates the sandy sea

face ; from Norman point to the northward extensive flats of mud stretch out into the Chittagong river. Embankments are constructed on the face of Norman point to protect this part from inundation. Numerous small villages dot the coast at about half a mile distant from the embankment alluded to.

A considerable creek, navigable by large boats, enters Chittagong river close to Norman point ; near the mouth is an extensive village, and about half a mile to the eastward a second village, with a large conspicuous tree near its western end.

LIGHT.—From a small brick tower, situated $1\frac{1}{4}$ miles southward of Norman point, an *occulting white* light, eclipsed *four seconds* in every half minute, and visible seaward from N. by E. $\frac{1}{2}$ E. to S.E. $\frac{3}{4}$ E., is exhibited. The light is elevated 38 feet above high water, and should be seen 10 miles.

STORM and TIDAL SIGNALS.—The signal station and flagstaff, 100 feet in height, is situated on Júldia hill, N.N.E. $2\frac{1}{10}$ miles from Norman point.

Storm and tidal signals are shown from this flagstaff.

The storm signals are used only to give warning of the early approach of a severe cyclone with its attendant storm wave. They are hoisted to the yardarm of the flagstaff on Júldia hill, and to that of the flagstaff at Sudder Ghât.

Day signals.—A ball indicates that a severe cyclone, of which the centre is in the neighbourhood of Akyab, will probably advance towards Chittagong.

A drum indicates that a severe cyclone, with its attendant storm wave, is approaching Chittagong.

Night signals. — Three lights, placed vertically, indicate that a severe cyclone, of which the centre is in the neighbourhood of Akyab, will probably advance towards Chittagong.

Two lights, placed vertically, indicate the early approach of a severe cyclone, with its attendant storm wave, towards Chittagong.

Patunga point, the northern high water entrance point to Chittagong river, is low, flat, and ill-defined, with but few trees. An extensive grassy plain extends some miles inland from its blunted southern point, and a flagstaff, white, with basket, situated about the central part of the high-water line, edging the mud flat of the point, affords a good mark. It bears from Júldia hill flagstaff S. 84° W. The mud flat off Patunga point is reported to be encroaching on the channel.

The coast from Patunga point northward, preserves a low unbroken aspect, trending north and forming the eastern shore of Sandwip channel. A white sand beach borders the coast, and at about $2\frac{3}{4}$ miles northward of Patunga flagstaff, Maheshkhali creek, which joins Chittagong river below Chittagong, enters the sea.

CHITTAGONG (KARNAFULI) RIVER,* the most important river in the Chittagong district, rises in a lofty range of hills to the north-east, and after pursuing a tortuous course, enters the district of Chittagong at the village of Chandraguna.

As far as Kasalang, or a distance of 100 miles from its mouth, the Chittagong river is navigable throughout the year for boats of 4 tons burden. About 20 miles above Kasalang navigation is stopped by Barkal rapids. Above Barkal, the stream narrows, its course being north for some distance until the Demagiri falls, three days' journey from Barkal, are reached, above which, the river becomes insignificant.

The chief tributaries are the Kasalang, Chingri, Kaptai, and Rankheong rivers, of which the two first are navigable by boats. Below Barkal rapids, the Chittagong flows in a bed composed of mud and sand, and its banks, covered with jungle, rise to a height of 60 feet. As far as Kasalang, or about 100 miles from its mouth, the tide is felt, and except during the rains, when the current is rapid, its flow is sluggish.

PILOTS.—In the south-west monsoon pilots cruise in their cutter by day, weather permitting, from the outer bar of the Chittagong river to the mouth of the Sangu river. In the north-east monsoon the cutter remains at her station by day and night, 3 miles south-westward of the outer bar buoys. The cutter carries a red and white flag at the masthead.

Least depth in channel.—The least depth to be passed over in entering Chittagong river is about 10 feet at low water springs, and about 18 feet at high water neaps (September 1891), but the depths are liable to change, and may be less. This is on the outer bar $1\frac{1}{2}$ miles westward of Norman point.

The lowest water is from November to June, the depths are about 2 feet greater from July to October.

Outer anchorage.—In case of necessity vessels may anchor outside the bar, in $5\frac{1}{2}$ fathoms, with Norman point lighthouse East and Patunga flagstaff N.N.E.

Bar.—In strong south-west winds a confused and dangerous sea breaks on the outer part of the bar.

* See Admiralty plan of Chittagong river, No. 84.

The best time for vessels to cross the bar is at slack water of high tide, and next to this, on the first of the ebb. The tides set across the outer part of the bar, the flood N.N.W., the ebb S.S.E. At springs, the flood tides run strong, and are apt to sweep vessels to the northward and westward of the river entrance.

Sailing ships are sometimes detained, on leaving the river during the south-west monsoon, owing to the unfavourable wind. A land breeze from the northward may generally be expected at night.

Buoys.—The entrance to the channel over the outer bar is marked by a black buoy on the starboard hand, and a red buoy on the port hand, entering from seaward; the former, lies West $1\frac{1}{4}$ miles, and the latter W. $\frac{1}{2}$ N., nearly $1\frac{1}{2}$ miles from Norman point. These buoys are liable to be washed away. The channel to Chittagong has black buoys on the starboard hand, and red buoys on the port hand, throughout.

Between the outer and inner bars there are 2 black buoys and 2 red buoys; 2 red buoys in the reach north-westward of Leaning tree; and 5 black buoys between Goaptu point and the fairway buoy on the rocky bar just below Chittagong. This last buoy, painted red, black and white, is surmounted by a staff and ball. These buoys are moved as changes occur.

DIRECTIONS.—As the entrance of the river is liable to change the following directions should be used with caution, and only in the event of being compelled to enter without a pilot. In April 1890 the mark for crossing the outer bar was to bring Leaning tree, situated on a hill on the east bank of the river, and N. $\frac{1}{2}$ E. $1\frac{1}{10}$ miles from Júldia flagstaff, in line with a beacon surmounted by a triangle and disc, and 4 cables from the tree, bearing N.E. $\frac{1}{4}$ N. This mark also led over the inner bar, and into the deep water off Júldia village, northward of Júldia hill.

TIDES.—It is high water, full and change, on the outer part of the bar at the entrance to Chittagong river, at about 0h. 45m. Springs rise 15 to 16 feet, and neaps 10 to 11 feet. During the south-west monsoon, April to October, extraordinary spring tides have been known to rise as much as 19 feet above low water spring tides datum of the dry season (January to April).

Off Júldia flagstaff, upon the inner part of the bar, the flood tide is half an hour later than at the outer part of the bar. Near the town of Chittagong high water occurs about 45 minutes later than at Júldia, and $1\frac{1}{4}$ hours later than at the outer part of the bar. The tidal stream changes, about $1\frac{1}{4}$ hours after high water, and

1½ hours after low water, off Chittagong, and 1½ hours after high and low water near Júldia. During the rainy season, April to September, the ebb runs with great strength. Under ordinary conditions, the tidal streams average about 2 knots at neaps, and from 3 to 4 knots at spring tides.

Five-tree hill has the appearance from the river of forming the southern limit of an extensive table land, of which Júldia hill forms a part, and has upon it, five trees, of which the central one is the most prominent.

Leaning tree has a flat umbrella top with two tufts on its stem; it is a mark for crossing both outer and inner bars, and for the reach northward of the tree.

White pillar, on the highest part of the ridge between Júldia flagstaff hill and leaning tree, is 15 feet high, coloured white, and surmounted by a lantern elevated about 90 feet above high-water.

Tide gauge.—Off Júldia hill station, on the edge of the mud bank lining the river, is a tide-gauge marked in 3 feet steps, by which the tidal signals governing the entry and exit of vessels, as signalled from Júldia hill, are judged.

Crossing marks.—Two miles northward of Júldia hill flagstaff, on the east or left bank, is a tripod surmounted by a barrel, the whole painted white; and 280 yards N. 15° E. of this tripod, is a second tripod surmounted by a pole, on which is a white cross facing southward, and over the cross a white disc facing westward. The barrel and cross in line lead up in deep water through the Júldia basin, clear of danger.

Flat tree is situated on the northern part of the ridge of hills, of which Júldia hill forms a part. It bears from Júldia flagstaff N. 14° E. distant $2\frac{1}{6}$ miles. Flat tree, in line with the white disc on the northern of the two tripods previously described on a S. 87° E. bearing, leads over the second bar, which extends eastward across the river from the north-east point of Patunga island.

A pole, used as a crossing mark on the western bank of the river, is situated on the north-east part of Patunga island, and is a rough guide for crossing, when bound up river. It denotes the limit to which vessels of 23 feet draught may be moored in the pool of the river above the second bar.

Second bar extends across the river at the elbow formed by the trend of the reaches of the river around the north-east point of Patunga island.

Crossing mark is the white disc over the cross on the northern tripod on the east bank of the river on with Flat tree on the ridge half a mile to the eastward, bearing S. 87° E.

Six creeks enter the river on the western side between Chittagong and the second bar. The eastern bank becomes low and swampy, and is broken up into four mud-formed islands locally known as chars. There is a passage for boats eastward of these chars at high-water.

Fakír hill, near the western extremity of the Chittagong hills, on the summit of which is a prominent tree, is the only conspicuous mark in the background of the river after the Júldia group of hills is passed. From Sandwíp channel it is reported to be visible at a distance of 15 miles on a clear day.

Moorings.—There are 16 sets of moorings for large vessels below Chittagong. The mooring buoys are painted black, and are much larger than the buoys marking the sides of the channel.

CHITTAGONG PORT second in importance of the ports of Bengal, affords access at highest spring tides to ships of 24 feet draught. With the improvements in lighting and buoying the approaches to Chittagong, the moorings which have recently been laid down for large vessels, and its steam-tug, Chittagong should continue to increase in prosperity, more so on account of the proximity of the port to the Meghna, tapping as that river does, much of the country traversed by the Ganges and Brahmaputra, and offering a waterway to the numerous native brigs and other craft which carry down from the river port of Narainganj, jute, rice, &c.*

Pier.—There is a government pier at Chittagong, with a depth of 12 feet alongside it at low-water ordinary springs.

A telegraph wire stretches across the river just above the town of Chittagong at a height of about 50 feet above high water. Small vessels bound up river, above the town, should lower their upper masts in consequence.

Trade.—Shipping.—The chief exports are rice, jute, and tea; valued in 1890 at Rs. 12,359,819. The principal imports are salt and kerosine oil; valued in 1890 at Rs. 848,585. During the year 1890–91 Chittagong was visited by 993 vessels, of an aggregate tonnage of 225,418.

Supplies.—Fresh provisions are to be had at Chittagong at moderate prices, and fresh water is supplied, at a rate of about Rs. 15

* A number of quaint looking country brigs, averaging from 50 to 300 tons, ply between Chittagong and Narainganj on the Meghna.

per 1000 gallons, by the Port department. For washing purposes the water brought down by the last of the ebb, about 2 miles above the town, will be found sufficiently cleanly.

Coal in quantities up to 100 tons can generally be purchased. It is shipped in the stream by boats.

Communication.—Chittagong is connected with the telegraphic system of India. There is communication by steamer with Calcutta and Rangoon. The great trunk road to Dacca, to the northward, runs from Chittagong parallel to, and at about three miles from, the eastern coast line of the Sandwíp channel. There is a daily post by land to Calcutta.

Repairs.—Small repairs can be executed.

Hospital.—Seamen are treated at the Municipal hospital.

THE TOWN, named by the Moguls in 1665 Islamabad, or the Residence of the Faithful, has an interesting early history attached to it.* It is situated on the western or left bank of the Chittagong river at about 12 miles from its mouth, and lies scattered with its villages amongst a group of small, steep, table-topped hills, the whole covering an area of nine square miles. The European residents inhabit the bungalows built on the summits of these hills. The chief buildings are the Government offices, Roman Catholic cathedral, Protestant church, mosque, school-houses, dispensary, post office, and club house. The merchants' offices and business quarters fringe the river's bank. Near at hand are the offices of the French and United States Consuls, two mills for cleansing rice,† agencies for various shipping companies, port office, custom house, &c. The population in 1891 numbered 25,322.

Health.—Although the native town of Chittagong, on account of the numerous disused tanks, is considered unhealthy, the port is not worse in this respect than other river ports of India. Vessels visiting Chittagong are permitted the attendance of a Government surgeon at a moderate charge. The most unhealthy month of the year is September, or towards the close of the rainy season. Fever is then prevalent. In the months of April and May epidemics of small-pox and cholera are most to be expected. An easterly wind, if of long continuance, is said to be unhealthy.

Winds, weather, and climate.—Chittagong is exposed to the south-west monsoon, and the rainfall is generally heavy, averaging

* Stewart's History of Bengal, pp. 187-189.

† Rice at Chittagong in husking is parboiled before shipment. This is said to give it superiority as a grain cargo over rice not similarly treated, which is liable in bulk to accumulate heat, at times to a dangerous extent.

between 105 and 106 inches.* A sea breeze usually prevails during the day rendering the air comparatively cool. The atmosphere is frequently loaded with moisture, causing heavy dew at night and occasionally dense fogs.

The prevailing winds from March to May are from south-west; from June to September from south-east to south-west; and from October to February from north-east. From the middle of October to March, the weather is fine and settled; but towards April the wind becomes more easterly, with occasional heavy north-westers in the afternoon. From about the end of April the south-west monsoon blows fresh in the upper part of the bay of Bengal; but near the land in the north-east part of the bay, land and sea breezes are met with. Near Chittagong, in the forenoon, the wind generally blows from the south-east and is moderate; towards the afternoon freshening up and veering to the south-west quarter. In June and July, during the height of the south-west monsoon, it blows hard from south-south-east to south-west with rain, leaving now and then a few comparatively fine days.

The following table is from observations taken at Chittagong at an elevation of 87 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		Mean.	Cloud.	Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	67	78	55	23	34	72	1·3	0·4	1	29·95	·11
February - -	71	81	58	23	36	70	1·8	1·2	2	—·91	·11
March - -	77	86	67	19	34	74	2·9	1·9	4	—·83	·11
April - - -	81	89	73	16	26	77	4·0	4·6	6	—·75	·11
May - - -	82	89	75	14	27	80	5·0	9·2	12	—·67	·10
June - - -	81	86	76	10	19	86	7·4	23·8	19	—·57	·09
July - - -	81	86	76	10	18	87	7·5	22·2	24	—·56	·08
August - -	81	86	76	10	16	87	7·2	20·5	23	—·60	·09
September -	81	87	76	11	18	86	6·5	14·1	18	—·68	·11
October - -	80	86	73	13	23	83	4·4	5·7	9	—·79	·11
November -	74	83	66	17	29	79	2·7	1·6	3	—·88	·11
December -	68	78	58	20	31	75	2·1	0·6	1	—·94	·11

* At the beginning of the present century, Chittagong was considered a sanitarium, and resorted to from Calcutta on account of its cool sea breeze.

Cyclones.—Although Chittagong is much exposed, serious injury is not often caused by cyclones. In 1849, and again in 1872, and in 1876, severe cyclones, accompanied by storm-waves, worked great havoc in the district. In 1849, large quantities of slime and salt were left upon the soil, when the sea water had again subsided to its natural level. In 1876, a severe epidemic of cholera occurred immediately after the cyclone, numbers of natives as well as several Europeans falling victims.

THE COAST of Chittagong from the entrance of the Sangu river, described at page 218, trends to the southward for about 9 miles, and is low and without any marked feature, it then recedes and becomes broken up by numerous shallow streams, and continuing its southerly trend for another 15 miles forms the eastern shore of the Kutabdia channel, about 2 miles in breadth, which cuts off Kutabdia island from the mainland. This channel, which from the present chart appears blocked, during the last century, under the name of the Okoia passage, was stated to afford excellent shelter for ships during the south-west monsoon. The entrance appears to be from the southward, or through a deep gut which runs up in a northerly direction between the North patches and the shore of Maskhal island.

For description of Kutabdia island and light see page 217.

Maskhal island.—Mattabari island is the next south of Kutabdia, and forms the eastern shore of the south part of the Kutabdia channel. It is separated from Maskhal island by the Mattabari channel, which is narrow and shallow. The south point of Maskhal island is about 15 miles southward of the south point of Kutabdia island. Maskhal island is hilly, the summit Garamchori, situated in the north-east part, being 288 feet in height.

Red Crab island is situated 2 miles S. by W. of the south point of Maskhal island ; it was formerly an islet of white sand with a few green shrubs on it, lying on the flat, dry at low water, which extends southward of Maskhal island. It is doubtful whether Red Crab island is any longer recognisable.

Maskhal channel divides Maskhal island from the mainland, but its entrance, which is to the southward, is blocked with shoals. The Baghkhali river, empties itself into the south-east part of the Maskhal channel, and on its left bank at a distance of about 2 miles from its entrance is the town of Cox Bazár with a population of about 5,000. Between Maskhal island and the mainland is a narrow channel leading to Cox Bazár, having depths on the bar of from $1\frac{1}{2}$ to 3 fathoms, and from 5 to 8 fathoms inside.

WHITE CLIFFS, visible from 18 to 20 miles, and a good land mark for making the coast during the south-west monsoon or in thick weather, if bound to Chittagong, front the coast from lat. $21^{\circ} 19'$ to lat. $21^{\circ} 24'$ N., at a distance of about 9 miles southward of Maskhal island. With the evening sun, these cliffs are conspicuous from the westward. Inland, at about 12 miles E.S.E. of White cliffs, Sugar loaf mountain rises to a height of 1,358 feet.

In case of necessity only, a vessel with good ground tackle might ride out bad weather near White cliffs in about 5 fathoms, which depth will be found $3\frac{1}{2}$ miles off shore; the bottom is said to be tenacious under a thin covering of soft mud.

Tides.—It is high water, full and change, near White cliffs, at about 11h.; springs rise 9 to 10 feet.

ELEPHANT POINT (Dombak), in lat. $21^{\circ} 10'$ N., is 9 miles southward of the southern part of the White cliffs, and is surmounted by a hill visible about 12 miles. A reef extends about a mile seaward from Elephant point, which should not be approached nearer than 4 miles, nor in a less depth than 10 fathoms. Northward of Elephant point and between it and White cliffs, at distances respectively from the point, of 3 and 7 miles, are the entrances of creeks. This part of the coast has not been thoroughly surveyed, soundings are scarce in the existing charts, and caution is therefore needed when navigating in the neighbourhood.

CHAPTER VI.

COAST OF ARAKAN AND BURMA—ELEPHANT POINT AND AKYAB
TO CAPE NEGRAIS.

 VARIATION 3° E. IN 1892.

THE COAST* from Elephant point trends S.E. for 11 miles to abreast Quoin hill, situated about $1\frac{1}{2}$ miles inland, and thence S.S.E. for 16 miles to a position where a break occurs, separating Shahpuri island from the mainland. This part of the coast forms the west side of a hilly peninsula, inside of which the Naaf river runs up to the northward, almost parallel to the trend of the sea shore. Table land or Horse head, 2,100 feet high, in about lat. $21^{\circ} 8' N.$ and 13 miles inland, forms a good landmark when a ship is to the northward of St. Martin's reef. There are but few off-shore soundings on the chart of this part of the coast, which has not been thoroughly surveyed.

Shahpuri island separated from the south end of the Naaf peninsula by a narrow channel, is 5 miles in length, north and south, by about 3 miles in width. This island has foul ground extending along its western coast to about a mile seaward. The channel amongst the shoals between Shahpuri and St. Martin's islands carries depths of from 2 to 3 fathoms, but its navigation is intricate and should not be attempted by strangers.

St. Martin's island, $4\frac{3}{4}$ miles in length N.N.W. and S.S.E. by about $1\frac{1}{4}$ miles in breadth, tapers to a point at its southern end, which is well marked by a single tree. The island consists of two or three islets united by ledges of rock; these islets are covered with jungle, having here and there scattered trees, averaging 40 feet in height, and visible 10 miles off. The northern part of the island is highest, and when approached from the south-west, appears as a bluff about 60 feet high. Off the west side of the northern portion of St. Martin's island is a low rocky islet, westward of which, the rocks dry at low water for about 2 cables.

* See Admiralty chart Elephant point to Chedúba strait, No. 821; scale, $m = \cdot 2$ of an inch.

Shoal water extends off the west side of St. Martin's island to the distance of about a mile. The I.G.S. *Hugh Rose* shoaled into 10 feet at half flood, with the north-west tree bluff of the island bearing N. by E., and the south point about S.E. by E. At 2 cables seaward of this position, the depths increased suddenly from 3 to 8 fathoms.

St. Martin's reef on which the sea breaks heavily at times, is of small extent, nearly awash, and bears from the south point of St. Martin's island about W. $\frac{1}{2}$ N. 10 miles. The position of this rock is doubtful, and great caution should be observed when in its vicinity.

NAAF RIVER* is the boundary between the provinces of Chittagong and Arakan. It is about 3 miles broad at its mouth, and extends parallel to the coast as a considerable stream as far north as Elephant point, receiving many tributaries. Depths of 7 and 8 fathoms are shown inside the shallow bars of this river, as far as the north-east point of Shahpuri island, beyond which no survey is extant. The outer bar is dangerous for shipping, as on the flood tide, which is the safest time to pass, the surf and swell run high in 3 fathoms of water, and the bottom is hard. No directions for entering can at present be given. Native craft trading to Tek Naaf enter the river by crossing the bar between Cypress point and St. Martin's island, the depth is said to be about 10 feet and the bar a shifting one.

Tek Naaf is a small town and telegraph station situated about 12 miles northward of the entrance of the Naaf river, near the right bank or Chittagong side. Ferry boats ply between this place and Maungdaw, the principal town of the district, on the opposite or Arakan side of the river.

Tides.—It is high water, full and change, at the entrance of the Naaf river at 10h. Springs rise 8 to 11 feet.

THE COAST from Cypress point, which is the point on the eastern side of the entrance to the Naaf river, trends about S.E. for $12\frac{1}{2}$ miles, forming a bight, to a well-marked point rising to Black hummock, close to the northward of which is a rock awash; there are extensive reefs with breakers about midway between Black hummock and the south point of St. Martin's island. The coast then continues on about the same bearing for $2\frac{1}{2}$ miles, where the Amdang, a small stream, enters the sea, and again continues a S.E. and S.E.

* See plan of entrance to Naaf river, on Admiralty chart, No. 821; scale, $m = 0.5$ inch.

by S. trend to the western entrance point of the Mayu river. High land runs parallel with this part of the coast, the southern peaks, of which (that in lat. $20^{\circ} 22' N.$ is perhaps the most conspicuous), are from 600 to 700 feet high. Abreast and northward of St. Martin's island, the hills become higher and more marked. High peak about 6 miles north-east of Maungdaw is 1,886 feet in height; northward of this is a low gap, and then two or three remarkable mountain tops. About 3 miles distant from this part of the coast, a depth of 6 fathoms will be met with; inside that distance, no soundings have been obtained, but for the whole distance between Cypress point and the western entrance point to the Mayu river, the coast is said to be fringed by a shoal bank having 3 or 4 fathoms on its outer edge, 2 or 3 miles off shore.

Asirgarh shoal, distant about 9 miles S.E. $\frac{3}{4}$ E. from the south point of St. Martin's island, and 6 miles from the coast, has over it a depth of 9 feet at low water, with $4\frac{1}{2}$ fathoms half a mile to the southward, and is considered dangerous.

Oyster Island, so named by Captain Ritchie, in 1770, from the number of oysters found there, is low, rocky, and of small extent, with jungle grass on its summit. It is situated about 10 miles from the coast, and is surrounded with dangers, specially off the south-east end, where shoal ground extends for a distance of about 3 miles. Oyster reef, on which a lighthouse formerly stood, bears from Oyster island S.E. $\frac{1}{2}$ S., distant about 9 miles.

A LIGHT is exhibited from a lighthouse, constructed of iron, painted black and white in alternate bands, and situated on the centre of Oyster island. The light is an *occulting* light, eclipsed for a period of *two seconds every half minute*, showing *white* through an arc of 345° , or from the bearing of N. 39° W., through east, to N. 54° W., and *red* through the remaining portion of arc (15°) over Oyster reef. It is elevated 130 feet above the sea, and should be seen 17 miles in clear weather.

Caution.—Vessels approaching Oyster island from the southward and westward should be careful when making the light in thick weather, owing to the great danger of Oyster reef. Endeavour to make certain of the position before standing towards the island, and, with the lead kept going, do not shoal to less than 20 fathoms, unless the light is sighted.

Mayu River, the entrance of which is eastward of Oyster island, has shoals on each side; and its formidable bar, on which are

depths of about $2\frac{1}{2}$ fathoms, is 3 miles seaward of the west coast of Akyab island. The Mayu is of considerable size, extending inland to the northward, parallel to the coast for about 55 miles or to near the latitude of Elephant point, and taking its rise in the mountains forming the northern boundary of the district. Strangers cannot enter without a pilot. Its mouth has occasionally been mistaken for that of the Arakan river.

The bank facing Mayu river, and extending thence along the land to Arakan river, has heavy breakers upon it during the south-west monsoon, and even in the north-east monsoon should not be approached.

OYSTER REEF, south-eastward of Oyster island, is $2\frac{1}{2}$ miles in extent N.W. by N. and S.E. by S., with 4 and 10 feet on its shoalest patches, on which the sea during the north-east monsoon does not always break. It lies West, 13 miles distant from Savage island lighthouse at the entrance of Akyab. The lighthouse which formerly marked Oyster reef was destroyed in a cyclone, May 1884.*

Buoy.—A conical red buoy, surmounted by a basket, is moored in 8 fathoms, about three-quarters of a mile south of Oyster reef.

Heckford Patch† having over it a depth of $4\frac{1}{4}$ fathoms, rock and coral, is 11 miles S.W. $\frac{1}{8}$ W. of Savage island lighthouse, and 9 miles S.E. $\frac{3}{4}$ S. from Oyster reef. A second patch having $4\frac{1}{2}$ fathoms, lies $1\frac{1}{4}$ miles W.S.W. of Heckford patch. These patches are steep-to on the west side, with 10 and 15 fathoms close-to, and 6 to 10 fathoms between them and Akyab bar. Vessels of heavy draught, approaching Akyab, should keep Prine Daung, the highest land on Western Borongo, bearing N.E. by E. to pass southward, or E. by N. to pass northward of the patches.

AKYAB.—ARAKAN RIVER.‡—Kaladan river is the largest and most important of the rivers which rise in the Arakan hills, but the mouth takes the name Arakan. The port of Akyab is situated immediately within the mouth of the river, the town of that name being on the western bank, about 2 miles northward of the western entrance point.

* Oyster reef lighthouse was an iron screw pile structure erected in 4 fathoms water, similar to the Krishna shoal lighthouse of the gulf of Martaban, which met with a similar fate.

† Discovered by Captain N. Heckford, in February 1855, who remarks that probably less than $4\frac{1}{2}$ fathoms may be found on it.

‡ See plan of Akyab, scale $m = 3$ inches, on Admiralty chart of Arakan river No. 1884.

Least depth in channel.—The least depth in the fairway from sea to Akyab is about 21 feet at low water springs, and 26 feet at high water neaps; situated on the Inner bar, north-eastward of Fakir point. A vessel of 26 feet draught has entered the port.

Savage island, on the eastern side of the entrance, is about 65 feet in height. Peaked rocks, above water, lie a quarter of a mile south-westward of Savage island; and Passage rock, 10 feet high, the same distance north-westward. White rocks, also above water, stretch about a mile south-eastward from Peaked rocks. Savage island may be recognised by the lighthouse on it; the most conspicuous land in the vicinity is Prine Daung, 5 miles south-eastward of the island, and 826 feet high.

LIGHT.—From a lighthouse, constructed of masonry, and 70 feet in height, on the north-west point of Savage island, a *fixed* and *flushing white* light, showing a flash *every minute*, and visible from S. 42° W., through east, to N. 25° W., is exhibited. It is elevated 118 feet above the sea, and should be seen 17 miles.

Fakir point, the western entrance point, is 1½ miles northward of Savage island. The point and the land north-westward of it are low, the country being cultivated, and covered with cocoanut groves. There is a flagstaff on the point from which a *fixed white* light is shown.

Fakir reef.—**Buoy.**—Rocks, which dry at half-tide, extend nearly 4 cables S.S.E. from Fakir point. A red buoy with staff and globe is moored S.S.E. ½ E., half a mile from Fakir point, to mark the extreme of the reef.

Bar.—Shoal water extends from Fakir point 5 miles in a south-westerly direction, and then trends 3 miles to the eastward. The sea breaks heavily over the east part of the shoal during the south-west monsoon. A red buoy with staff and globe is moored off the eastern part of this shoal; between the buoy and Borongo island is the bar, with from 21 to 28 feet on it at low water.

Harbour light.—A *red light* is shown from the extremity of the stone pier, situated 1¼ miles northward of Fakir point.

Flat island, about 5 miles north-eastward of Fakir point, is low and covered with brushwood. Flat island spit, which dries at low water, stretches more than 2 miles south-westward from the south-western side of Flat island; the extension of the shoal ground for 1½ miles southward of the south extreme of the spit, forms the eastern side of the channel opposite Akyab.

Buoys.—A black buoy marks the southern extreme of the above shoal ground, it is moored about $1\frac{1}{4}$ miles N.N.E. from Fakír point. Another black buoy, about $1\frac{1}{8}$ miles N. by E. from the first buoy, marks the eastern side of the channel immediately above Akyab.

DIRECTIONS.—Vessels bound to Akyab during the south-west monsoon should steer for Borongo island, to make Prine Daung, which is visible 30 miles in clear weather, but should not approach within 5 or 6 miles of it, and keep along the coast at the same distance (taking care to avoid Heckford patch), until Savage island lighthouse is seen. The lighthouse should be steered for, bearing North until the outer red buoy is sighted, when Fakír point flagstaff should be brought in line with the lighthouse, bearing N. $\frac{3}{4}$ W., which will lead over the bar in 27 feet at low water.

After crossing the bar, or when the bar buoy bears W.S.W., steer N.W. by N. to avoid the rocks extending southward of Savage island, which are steep-to. When the lighthouse bears East, steer N.E. by N., with Passage rock on the starboard bow, until the lighthouse is in line with Passage rock, then steer N.E. by E. $\frac{1}{2}$ E. to avoid Fakír reef, leaving the red buoy at its south-east extreme on the port hand. When Fakír point bears N.W., haul to the northward for the anchorage, leaving the black buoy marking the extremity of the reef extending from Flat island, on the starboard hand.

Caution.—When coming in with the flood, great care is required in allowing for the tide as it sets on to the White rocks. In going out with the ebb tide, keep as near to those rocks as prudence will allow, in order to prevent being set on the Western bank.

Anchorage.—A vessel may temporarily anchor with Savage island lighthouse S.S.W. and the North and South Hummocks, on Borongo island, in one, in 9 fathoms. The best anchorage for large ships is off the Charúgyea creek, 3 miles northward of Fakír point, and about $1\frac{1}{2}$ cables off shore.

A safe passage for boats and small schooners is between Savage island and the north end of Borongo island, sheltered from the sea in the south-west monsoon.

Tides.—It is high water, full and change, at Akyab, at 9h. 57m.; springs rise 8 feet, neaps 5 feet. In the rainy season (April to October) the rise is from 2 to 3 feet more. The streams are regular, and run swiftly at springs, when they form heavy overfalls, on the ebb, between Fakír reef and Passage rock. During neaps, the streams are almost imperceptible.

Akyab town is of considerable importance in connection with the rice trade, and the headquarters of the Arakan Division and the Akyab District. The population in 1891 numbered 38,921.

Piers.—There are three piers off the town ; one reserved for mail steamers, has a depth of 24 feet alongside at low water springs ; the others are used only by small native craft.

Coal.—Only sufficient for local purposes is kept. If arrangements were made for coaling, vessels could do so in the stream.

Communication.—Akyab is connected with the telegraphic system of India. There is steam communication with other ports.

Supplies.—Repairs.—Provisions are plentiful and cheap. Only very small repairs can be effected to hull or machinery of vessels.

Trade.—Shipping.—The chief export is rice ; the chief imports are piece goods, liquors, betelnuts, metals, tobacco, vegetable, and mineral oils, &c. The total value of exports and imports in 1890 was Rs. 18,866,556.

The number of vessels that entered the port of Akyab in 1890 was 478, of 159,977 aggregate tons.

Quarantine.—There are special quarantine regulations at Akyab, a copy of which should be obtained from the Harbour authorities.

Hospital.—There is a hospital and a sailors' home at Akyab.

Winds and Weather.—The south-west monsoon begins early in May, and lasts until the end of October. About the time of full and change of the moon, it will often be found that the south-west monsoon increases in strength, blowing more from the south, accompanied by heavy rain and sea, making it at such times necessary to approach the coast with great caution. In the north-east monsoon the wind blows nearly round the compass. Commencing at north in the morning, and hauling gradually to the south and east towards noon, then calm until the sea breeze sets in from west and south-west, hauling round to north-west in the evening. These winds prevail with regularity from November to April or May.

STORM SIGNALS are shown at Akyab. For details of signals see page 27.

Climate.—The following table is from observations taken at Akyab, at an elevation of 20 feet above sea level.

The rainfall in the south-west monsoon is very heavy. At this period the whole country becomes almost inundated, and the various rivers send down large volumes of water. The winter months are very dry.

Month.	Temperature.					Humidity.		Cloud.	Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		Mean.	Mean.		Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.							
	°	°	°	°	°							
January - -	69	82	59	23	34	72	1·6	0·1	...	30·00	·11	
February - -	73	85	60	25	37	70	1·1	0·2	...	29·95	·12	
March - -	79	89	68	21	34	73	1·9	0·5	1	—90	·12	
April - -	84	92	75	17	26	74	3·0	1·6	2	—83	·12	
May - -	84	91	77	14	25	78	5·3	12·2	14	—76	·10	
June - -	82	86	77	9	18	87	7·0	51·6	27	—68	·09	
July - -	81	84	77	7	15	89	8·5	51·0	29	—67	·08	
August - -	81	85	77	8	15	89	8·0	38·6	28	—71	·09	
September - -	82	87	77	10	16	86	6·9	23·0	22	—76	·11	
October - -	81	88	76	12	19	83	4·8	12·4	12	—85	·11	
November - -	78	85	71	14	25	81	3·2	3·9	3	—94	·10	
December - -	72	82	64	18	30	77	2·5	0·6	2	—99	·11	

Borongo island, forming the south side of entry to Akyab, is 17 miles in length N.N.W. and S.S.E.; Prine Daung, the table land at its northern end, some 826 feet in height, can be seen from a distance of 30 miles, and forms a conspicuous landmark in approaching the port. A beacon stands on the highest part of Prine Daung, but in 1886 the beacon could not be seen from seaward. Almost the whole island, which is narrow, is high and thickly wooded. At its southern end is a hummock, and detached rocks with foul ground extend 3 miles southward from the southern extremity of the island.

The COAST.—Immediately eastward of Borongo island is Peni Kyong, a similar high thickly wooded island, separated from Borongo by Research strait, which is deep at its southern, but blocked by shoals at its northern end. Duff island lies off the south end of Peni Kyong island, and Barn island about 75 feet high, of reddish colour, with South rocks, which are white and flat, and a rock

awash (doubtful), continue in a S.S.W. direction for a distance in all of $8\frac{1}{2}$ miles from the south point of the island. Angrei Kyong forms a similar island eastward of Peni Kyong, again separated by a strait in which is anchorage in 6 fathoms at its southern end, but shoal water in the northern part, which narrows considerably, and finds exit in the mouth of the Chankhun dan river, eastward of the port of Akyab.

Hunter bay, 11 miles across east and west, inside Angrei Kyong, is but little known, and seldom entered by seagoing ships, the trade of the chief towns within it being carried on by native vessels. The central part of the bay is shallow, with narrow channels indicating the entrances to the numerous small rivers or creeks, which flow into it. On the eastern side of the bay, the land is high with a bold coast. The south peak of the lofty ridge which lines this shore, Keuain Kaun Taung, bearing E.S.E. distant 32 miles from Prine Daung, Borongo island, is conspicuous, and visible 40 miles in clear weather.

COMBERMERE BAY forms a considerable inlet, the head of which branches into numerous small straits and rivers, the most important of which is the Aeng, which is navigable by boats as far as the town of the same name, situated on the left bank, 23 miles from its mouth. Depths of from 5 to 12 fathoms are to be found in Combermere bay, but many islands, shoals, and groups of rocks are scattered over it, for the position of which the chart is the best guide. The navigation of the bay is intricate and dangerous, and it is rarely entered by European ships, the trade of the district being carried on by native craft.

Wood harbour* to the north-east of Tangaro island, in the southern part of Combermere bay, affords anchorage on a ridge of from 5 to 8 fathoms, mud, with the eastern extreme of Catherine bluff (at the north end of Tangaro island, bearing West, and a gap in the hills of the same island bearing S.W. by W. $\frac{1}{2}$ W.

The entrance to this harbour is easily distinguished by the bluff extremes of Narkumbau and Tangaro islands. Before closing the entrance, the north end of Tangaro island should be brought to bear E. $\frac{1}{4}$ S., in order to avoid some irregular soundings extending N.W. of Crooked island.

At springs the tide runs through the entrance of Wood harbour with a strength of about 3 knots.

* Commander A. Carpenter, R.N., 1885. See plan of Kyauk Pyu harbour, No. 831; scale, $m = 2$ inches.

KYAUK PYU HARBOUR, meaning "White Stone," is a well-sheltered anchorage, formed by the north end of Ramree island on the south, and on the north, by a chain of smaller islands; the latter extend for a considerable distance to the north-eastward into Combermere bay, forming between them numerous small straits and boat passages. The harbour is open only to the W.N.W., and vessels at the anchorage are, from that quarter, well protected by Dalhousie point, the north-west extreme of Ramree island.* The upper, or eastern portion of the harbour, narrows to about $1\frac{1}{4}$ miles in width at 3 miles eastward of the anchorage, whence it abruptly turns to the S.E., forming, for boats, a broad, safe, and convenient passage (Fletcher Hayes straits) 18 miles in length, and communicating by means of a smaller creek with the large inlet on the south-east side of Ramree, which inlet enters the sea near Chedúba island. The native village of Kyauk Pyu is small, and the only European residents are two or three Government officials. There is a gaol and school. The town police number 83, and there is a district force of 275. The trade is of little importance, as the produce of the surrounding country is taken to Akyab in native boats through the numerous creeks and inlets; the harbour is therefore but seldom resorted to by shipping.

Reef island, the north-western island at the entrance to Kyauk Pyu, is small, low, sparsely wooded, and of reddish earth; it is not conspicuous when making the coast, as it is hidden by the higher wooded peaks of the islands to the eastward of it. Dangerous reefs are said to extend for 2 miles to the north-west of Reef island, and as the locality has not been closely examined, vessels making the port should not approach the island within 3 miles in that direction.

Saddle island, on the south side of the entrance to Kyauk Pyu, and 156 feet high, is easily recognised from a distance of 10 miles in moderately clear weather; the island is half a mile long, 300 yards broad, and has two rounded summits, sparsely covered with trees. From its south extreme, reefs of rocks above water extend in parallel ridges for fully one mile. Shoal ground, on which the sea sometimes breaks, extends upwards of a mile westward of Saddle island: Two small rocks, 6 and 5 feet high, lie $4\frac{1}{2}$ and $6\frac{1}{2}$ cables respectively from the north end of the

* See Admiralty charts:—Kyauk Pyu harbour, No. 831; Elephant point to Chedúba, No. 821. The remarks on Kyauk Pyu harbour are chiefly by Navigating Lieutenant F. W. Jarrad, R.N., 1877.

island, whence shoal water extends for nearly $1\frac{1}{2}$ miles in a north direction. In consequence of numerous sunken dangers which surround this island vessels should not approach it too closely.

Giles bank, with a depth of $4\frac{3}{4}$ fathoms at low water, is situated in the middle of the entrance to the harbour, N. $\frac{1}{2}$ E. $2\frac{3}{16}$ miles from the northern end of Saddle island.

Dicey shoal, on which the sea sometimes breaks heavily, is the extreme of the rocks stretching northward from Saddle island. A black nun buoy, with staff and ball, is moored about 3 cables northward of this shoal, and N. $\frac{1}{4}$ W. $1\frac{1}{2}$ miles from Saddle island.*

Research rock.—A sunken reef, believed to be about one-third of a mile in extent, lies about S. $\frac{3}{4}$ E. $5\frac{1}{2}$ miles from the south point of Saddle island with soundings of 7 to 11 fathoms close to.

Cap and Knot islands are two small islets lying S.E. by S. and S.E. by E. $\frac{1}{4}$ E., each $1\frac{1}{2}$ miles from Saddle island, and about one mile from the shore of Ramree island. The former (148 feet) is bold and conspicuous, while the latter is low with a few shrubs on it; both islets are surrounded by reefs. Between Saddle island and the coast of Ramree, numerous isolated rocky patches exist, and there is no safe channel in this direction.

Ramree island.—The northern part of this island forms the south shore of Kyauk Pyu harbour. The coast from abreast Cap island, trends to the northward and eastward in a succession of sandy beaches and rocky points for a distance of 5 miles to Dalhousie point. The coast is fringed with off-lying rocks, which, in some places, extend 2 or 3 cables seaward.

Dalhousie point is low and sandy, with a large clump of palm trees and the remains of a fort on it; at $1\frac{1}{4}$ cables to the south-east from the point is an iron pier. The whole of the north shore of Ramree is thickly wooded, and when entering the harbour, the high trees on Dalhousie point render it easy of recognition. The sea is making rapid encroachments on the shore westward of Dalhousie point.

From Dalhousie point a sandy beach, with a foreshore of mud which dries out from $1\frac{1}{2}$ to 2 cables at low water, trends E.S.E. for $1\frac{3}{4}$ miles to the mouth of the "Ungyaung creek. The village of Kyauk Pyu is built on this beach amongst tall palm trees.

A black buoy, with staff and ball, is moored eastward of Dalhousie point, about a cable from the shore.

* The exact position of the buoys in Kyauk Pyu harbour cannot be relied upon.

Pagoda rock, lying $4\frac{1}{2}$ miles N.E. $\frac{1}{2}$ N. of Saddle island, is a small but conspicuous landmark for making the harbour, and, as its sea face is occasionally white-washed, is an excellent guide. The rock is 85 feet high, of conical form, with two sharp-pointed summits close together, and is steep-to, except on its east side, where a ledge projects about a cable. The edible-nest swallow (*Collocalia unicolor*) is found here.

Crooked island, on the north side of the harbour, is low, and its west side is skirted by reefs and detached rocks, foul ground extending north-west of it for three-quarters of a mile. A low wooded ridge, about 50 feet high, extends from the middle of the island southward; on the north end of the ridge is a small white pagoda. The eastern and southern shores of the island are low and swampy.

Squadron rocks, low, narrow, and rocky, with a few shrubs and a solitary tree, lie parallel to the south point of Crooked island. A rock awash at low water lies 3 cables S.S.E. from the south end of Squadron island.

Quoin island, of triangular shape, thickly wooded, and the summit of which is 260 feet high, lies close south-east of Crooked island. When viewed from seaward, Quoin island appears wedge-shaped, and has lighter foliage than the hills behind it. From its south point a ledge extends for a quarter of a mile to the south-eastward, the water immediately deepening to upwards of 40 fathoms.

Tangaro island, a long, narrow, thickly-wooded island, of irregular shape, its hills varying from 50 to 465 feet in height, lies about 3 cables to the eastward of the above islands, and with them forms the northern shore of Kyauk Pyu harbour. The space between Quoin island and the southern point of Tangaro island, is occupied by a shallow flat, on much of which the depths are less than one fathom.

Laws island, southward of the southern point of Tangaro island, has a conspicuous tree on its summit (which is 590 feet high and covered with foliage), useful as a leading mark in entering Kyauk Pyu harbour.

North shoal, consists of a small rocky patch, the western part being awash at low water springs. It lies $1\frac{1}{4}$ miles W. $\frac{1}{2}$ N. from the southern point of Quoin island. A red buoy with pole and basket, is moored $1\frac{1}{2}$ cables southward of North shoal.

Bombay shoal consists of a narrow tongue of rocky ground on the south side of the channel, half a mile northward of Georgina point of Ramree island. It rises abruptly from deep water, and has as little as 11 feet over it; the position being generally marked by overfalls.

Reliance shoal, with a least depth of 9 feet, lies N.E. $\frac{1}{4}$ E. $1\frac{1}{4}$ miles from Georgina point. A black buoy, surmounted by staff and ball, is moored $1\frac{1}{2}$ cables northward of Reliance shoal.

Anchorage.—The best anchorage is to the south-eastward of Dalhousie point, in from 9 to 11 fathoms, mud bottom, with the pier bearing West to W.N.W. half a mile distant. This anchorage is subject to strong eddies at springs, but at neaps there is very little movement of the water.

Vessels may anchor in Southampton road, eastward of Dicey shoal; but the holding-ground (broken shells and stones) is not good. Vessels unable to reach the harbour before nightfall may anchor, in fine weather, on the flat off the entrance to Combermere bay, in from 7 to 9 fathoms, mud bottom, good holding ground.

DIRECTIONS.—Approaching Kyauk Pyu from the southward, a steam-vessel may pass eastward of the Terribles, by keeping Nongodi island summit (a high conspicuous wedge-shaped mountain in Combermere bay), in line with the extreme northern point of Satellite island, N.E. by N., until South Terrible bears West; then alter course to the northward, and bring Nongodi summit well open westward of Satellite island N.E. $\frac{3}{4}$ N., to pass westward of Irrawaddy shoal. The last mark may be kept on until the single tree on Laws island bears E. $\frac{1}{2}$ S. when steer for it on that bearing; leaving the black buoys on the starboard hand, and the red buoy on the port hand. A sailing vessel, however, should not attempt the passage inside the Terribles. No vessel should pass between Irrawaddy shoal and Saddle island.

Making the port from the northward or westward a vessel should steer to the south-eastward until Pagoda rock bears East, not bringing it northward of that bearing until North Terrible bears westward of S.S.W., when Saddle island may be steered for until the tree on the summit of Laws island bears E. $\frac{1}{2}$ S., which leads well to the northward of Reliance shoal, then steer for Dalhousie point (which is steep-to), and haul to the south-east for anchorage off the pier as above directed.

Tides.—It is highwater, full and change, at Kyauk Pyu pier, at 9h. 26m. (approximate). Springs rise 10 feet 6 inches, neaps rise 6 feet 6 inches, neaps range 2 feet 6 inches. The velocity of the

tidal stream varies from one to 3 knots an hour; the flood outside Saddle island, setting to the northward, the ebb to the southward. The movement of water is remarkably slack at neaps.

Supplies of any kind are scarce, but occasionally beef of inferior quality may be procured. A few fowls, ducks, and also vegetables can be obtained. Repairs to ships cannot be made at Kyauk Pyu.

Good water is obtainable from wells.

Exports, chiefly to Akyab and Chittagong, consist of hides, horns, petroleum, and salt. Paddy and timber are also sent to Akyab for export.

Communication.—Telegrams are sent to Akyab and Rangoon by weekly post for transmission. The British India steam vessels to Calcutta and Rangoon call weekly. A small steam vessel plies through the Wembaik creek to Ramree, Taungup, and Chedúba.

THE TERRIBLES,* about 9 miles westward of Saddle island, form three visible groups of rocks, extending, with their surrounding sunken dangers, in a N.N.E. and S.S.W. direction for nearly 8 miles. North Terrible, 12 feet high, is the largest rock of the group, and has sunken dangers extending 2 miles northward from it; and a similar distance W.S.W. This rock is situated in about lat. $19^{\circ} 27' N.$, long. $93^{\circ} 18' E.$ The middle group is about a mile S.S.W. from North Terrible. South Terrible, consisting of several low rocks, is 4 miles S.S.W. $\frac{1}{4}$ W. from the North Terrible, and breakers extend S.S.E. nearly 2 miles from it; with foul ground also between it and the middle group.

Caution.—Unless bound for Kyauk Pyu harbour or Chedúba strait, the Terribles should not be approached nearer than a depth of 20 fathoms to the southward, or 24 fathoms to the westward; and vessels are cautioned against a too close proximity to them during the night, when working up the coast.

Irrawaddy shoal of rock and small stones, consists of two patches lying one mile apart, in a north and south direction. The northern patch of broken rock, with a depth of $2\frac{1}{2}$ fathoms (possibly less), lies with Saddle island summit bearing E. $\frac{1}{2}$ N., distant $3\frac{1}{4}$ miles. The southern patch is a narrow ridge with a depth of 4 fathoms lying three-quarters of a mile southward of the northern patch, and is generally marked by tide rips. The swell breaks on the northern patch in heavy weather.

* A lighthouse has been proposed for the Terribles.

Caution.—There are several shoal patches between Irrawaddy shoal and Saddle island, and vessels should not attempt to pass eastward of Irrawaddy shoal until the locality has been thoroughly examined.

RAMREE ISLAND, the south-west coast of which forms the eastern side of Chedúba strait, and the south-east coast the western side of Ramree harbour, is 42 miles in length north-west and south-east, by from 7 to 17 miles in breadth. The island is crossed by a range of mountains elevated from 500 to 1,500 feet. The north-west coast of Ramree from West point southward, trends S.E. $\frac{1}{4}$ S., is tolerably straight, and appears rocky, with a few detached rocks above water lying near the shore. This part of the coast rises somewhat steeply from the sea to a range of high hills, the most prominent peaks of which are known as Outer peak, North Pap hill, and Tree summit.

The town of Ramree, situated about 13 miles up a river on the eastern side of the island, has a population of about 4,000, and carries on a small coasting trade with Chittagong, Sandoway and Bassein.

Thames point about 16 miles south-east of West point is low, and has some tall trees growing on it.

Rocky point, 10 miles to the south-east of Thames point, and forming the north-east point of Chedúba strait, is low; a beacon was erected on it in 1884. The bight formed between Rocky and Thames points has depths of 4 fathoms, at the distance of 2 miles from the shore.

Shoals North of Chedúba island.—At 6 miles and $7\frac{1}{2}$ miles N.W. by N. of Beacon island, off the north-west coast of Chedúba island, are two small shoals, which break in heavy weather. The northern has 4 fathoms over it, rocky bottom; the southern has 5 fathoms, mud. Between these shoals and Beacon island, the ground appeared clear of danger.* To avoid these shoals, vessels, when passing them, should not bring the western extreme of the visible land of Chedúba island to bear southward of S.E. $\frac{1}{2}$ S.

CHEDÚBA ISLAND,† moderately high, is situated southward of Ramree island on the Arakan coast and is 18 miles long, extending between lat. $18^{\circ} 40'$ N. and lat. $18^{\circ} 55'$ N. Its west coast is high, gradually rising from the north end, which is low, to its southern

* See Admiralty chart No. 832 of Chedúba strait and Ramree, scale, $m = 0.4$ inch.

† Remarks on Chedúba island, strait, and adjacent islands and dangers, from Commander A. Carpenter, R.N., December 1884.

peak, Palangutaung, which rises to a height of 885 feet. The eastern coast is flat, and the greater part of the island is cultivated, and covered with foliage.

Centre peak is conspicuous, solitary, and 819 feet high. Pagoda peak, 725 feet high, has two small pagodas, with a single tree between them, on its summit.

Between Chedúba and Ramree islands are the Chedúba straits, navigable by vessels of moderate draught.

Chedúba town (Man aung) stands on the banks of a small stream flowing into the straits, and the produce of the island, which is chiefly rice, is carried to Kyauk Pyu and Akyab for exportation. Cattle, poultry, and fruit can be obtained at reasonable prices, also wood, but good fresh water is scarce during the dry season.

COAST.—From the north-west point of Chedúba island (which is low, and has an extinct mud volcano upon it,) the land trends E.N.E. 8 miles to Searle point, and thence in a slight sweep E.S.E. 8 miles to Sandy point, which is low. The soundings on the whole of the north shore are shallow, and west of Searle point the offshore is very foul.*

Off the north-west point of Chedúba there is extensive shoal ground, covered with large boulders, some of which show above water. In the centre of this shoal ground, is a space nearly clear of rocks, termed port Childers, but it is a dangerous and unnecessary anchorage, and the mariner will do well to avoid it. If desiring to anchor in that vicinity, there is excellent holding ground off Searle point, north of the island, or one mile N.E. of Beacon island.

Beacon island, having on its highest part a small stone beacon 17 feet high, painted white, is a stony islet, 4 cables long and 30 feet high. It lies 4 miles N.W. by N. of the N.W. point of Chedúba island. Bearing W. by N. $\frac{3}{4}$ N. 8 cables from Beacon island, is a rock which covers at high water spring tides, having three heads close together. This is the outer danger.

Henry rocks, 3 miles W.S.W. of the N.W. point of Chedúba, have a pinnacle 17 feet high. Six cables S.W. of this pinnacle are two rocks which never quite cover. From the outer rock, W. by N. of Beacon island, the danger line extends southward 5 miles to the outer limit of Henry rocks, and thence south-east parallel to the

* The work of erecting a lighthouse on Chedúba island, in 1884 had been stopped owing to want of funds.—(*Official Report on the Lighthouses of British Burma*, 1883–84, page 1.)

west coast of Chedúba island. The outer danger along this coast is a submerged rock abreast West hummock, distant $1\frac{1}{4}$ miles from the shore.

West coast of Chedúba island is bold, and faced by numerous detached masses of sunken rock. Native craft familiar with its dangers frequent it during the north-east monsoon for rice. West hill, nearly half way down the coast, is 695 feet high, and is wooded. South peak (Palangutaung) at the south end of the island, is 885 feet high, and visible from beyond the limit of soundings. These mountains are excellent marks for vessels making the island from the west or south-west. The only bay on this side of Chedúba is at its south-west end, immediately westward of South peak, where Pyramid bay (so named from a pinnacle rock 208 feet high, lying off it) affords good anchorage to native craft during the north-east monsoon. South of Pyramid rock is a reef, that extends off the south end of the island for about 2 miles.

The tidal stream on the west side of Chedúba island follows the general trend of the land, and flows at rates similar to those that prevail in the vicinity of Beacon island. The north-east monsoon, though not affecting the regularity of the land and sea breezes, appears to induce a set to the southward. The indraught between Chedúba island and Flat island, off its south end, is considerable.

East Coast.—The south point of Chedúba island is very foul, and there is no passage between it and Flat island. From the south point, the coast trends northerly, forming the west side of Chedúba strait, the first 4 miles being high, and the remainder low and thickly wooded. A creek leading to Chedúba town flows into the sea 10 miles up this coast. The town stands on its north bank about 2 miles from the mouth. A pagoda, half a mile north of the entrance is conspicuous when newly whitewashed (every autumn). There is shoal ground off this coast extending out to Round island.

The shallow ground extending from the east side of Chedúba island is prolonged in a south-east direction for upwards of 7 miles from the S.E. extremity of the island. Upon it are three islands.

Tokwekwong or Round island is one mile long with an even rounded summit, 290 feet high ; this island forms a useful mark.

Flat island, the middle of the three islands is low, 4 miles in length north and south, and has a slight elevation in the centre, 105 feet high.

Hill island, three-quarters of a mile south from Flat island, is 80 feet high. The edge of the shallow ground near Hill island is steep, and should not be heedlessly approached.

Vessels must not attempt to pass between Chedúba and Flat island, as the water in the channel shoals gradually from 8 to $1\frac{1}{2}$ fathoms. Hill island ought not to be approached on its southern and western sides nearer than a mile. South rock, 8 feet high, lies half a mile south from the island.

Volcanoes.—Several extinct mud volcanoes exist amongst these islands, but one larger than the rest on Chedúba is active, according to native report, twice a year. An eruption of it was seen from the *Investigator* in December 1884, the flaming gas reaching a height of 500 feet, and lasting four minutes. This volcano is situated near the southern end of the island.

CHEDÚBA STRAIT.—This strait extends from the north point of Chedúba as far south as Unguan or Tree island, south of which there is no protection afforded from the south-west monsoon. The portion between Searle point and Round island is alone intricate, the least depth of the channel being $3\frac{1}{2}$ fathoms at low water spring tides, and the width of the deep channel one to 2 miles.

A table mountain N.N.E. from Rocky point of Ramree island is a conspicuous object when seen from the north-west, but Rocky point has no features by which it can be recognised. Helby hummock, small and wooded, is conspicuous when approaching from the northward, and will, with the highest part of Ramree hills, afford objects for obtaining cross bearings. Button island, 115 feet high, lying under Ramree hills is useful when coming from the southward, but is not easily distinguished from the westward. A beacon, 30 feet high, and surmounted by a basket, was placed on Rocky point in 1884.

Three miles S.S.W. of Rocky point is a shoal patch of 3 fathoms, and from this a line of shoals which narrow the 4-fathom channel to 6 cables, and the 3-fathom channel to 8 cables, trends about E. by S. and W. by N., and its eastern extreme bears S. by E. from Helby hummock; the least water on these patches is $1\frac{1}{4}$ fathoms. The coast of Ramree north of Rocky point is clear, and has 4 fathoms at a distance of 2 miles. Rocky point has 4 fathoms at $1\frac{1}{4}$ miles south of it, with shelving bottom.

DIRECTIONS, from northward. — When approaching Chedúba strait from the northward, Chedúba hills will be seen ahead, Centre peak being the most conspicuous and isolated, with Pagoda peak immediately westward of it. To the south-east, the

high Ramree hills adjoining the strait will be noticeable, falling somewhat abruptly to the water, no other hills being visible to the southward of them, except those of Chedúba island. The summit of the Ramree range is marked by a slight lump. Helby hummock, will be seen in the same direction, with a moderate sized wooded hill to its left, both being seen over the low ground of Rocky point. There is a small shallow bay east of Rocky point, beyond which, another slight point projects, having a whitewashed beacon on it, and a sandy beach below.

Follow the coast at a distance of 3 to 4 miles until the highest part of Ramree hills bears E. by S., when bring the dome-shaped hillock, 285 feet high, which marks the south extreme of the range, and is close to the coast $4\frac{1}{2}$ miles north-westward of the south point of Ramree island, to bear E. by S. $\frac{3}{4}$ S., and steer towards it, keeping it on that bearing, until the red buoy* with staff and basket, moored at the edge of the bank off the southern coast of Ramree island, about 3 miles south-eastward of Rocky point, is seen. From the buoy, the highest summit of the Ramree hills bears E. $\frac{3}{4}$ S. Vessels should pass 2 cables south of this buoy, then keep it just open of Rocky point until Helby hummock comes in line with the wooded hill at its back, bearing N.N.W. $\frac{1}{4}$ W.; then haul to S.S.E. $\frac{1}{4}$ E., keeping the two in line to clear the east end of the shoals. A blunt conical hill will then be seen to the northward touching the left shoulder of the wooded hill behind Helby hummock. This cone kept just touching the left shoulder of the wooded hill, N.N.W. $\frac{1}{4}$ W., (*see* view on Chart No. 832), leads between the shoal water on the east coast of Chedúba, and the shoal middle ground between there and Sagu island, preference being given to the middle ground side, of which warning can be got by the lead. If bound to Ramree harbour, a vessel should keep the last leading mark on until Round island bears S.S.W.

Approaching from southward.—Pass eastward of Round island at the distance of from one to 2 miles, and when it bears West, steer N.N.W. $\frac{1}{4}$ W. for the visible west extreme of Ramree island. A double hill will then be just lifting above the horizon. This double looking hill is the wooded hill mentioned above with the blunt cone touching its shoulder and forms the leading mark up to the shoals at the Narrows. Keep on this mark until the summit of the Ramree range bears E. $\frac{1}{4}$ N. when alter course to W. by N. $\frac{3}{4}$ N. keeping the dome-shaped hillock astern, and passing southward of the red buoy.

* Liable to be washed away.

RAMREE HARBOUR.—The south coast of Ramree island forming the north side of Chedúba strait, extends to within $1\frac{1}{4}$ miles of Sagu island leaving a deep channel between, in which are 20 to 40 fathoms of water. This is the entrance for large vessels into Ramree harbour. From the southward near Round island, a conspicuous isolated clump marks the whereabouts of this channel (which is locally known as the Gates). From here, the harbour trends northward for 18 miles, with an average breadth of $3\frac{1}{2}$ miles, forming an arm of water separating Ramree island from the low swampy islands adjacent to the mainland. There is excellent anchorage all over it, but it contains several shoals and rocks which must be avoided.

Sagu island is the largest of the group lying off the south point of Ramree. Its greatest length is in a N.W. and S.E. direction, about $4\frac{1}{2}$ miles, its breadth being $2\frac{1}{2}$ miles. From the north point of Sagu island, Dragon shoal, of varying depth, having rocks and shoal patches throughout its length, trends N. by E. $\frac{1}{2}$ E. for 5 miles, terminating about a mile beyond, in a group of rocks above water, one of which is white. Some rocky patches of 3 fathoms extend out three-quarters of a mile from the Ramree shore 2 miles N.E. of the south point of that island, leaving a channel of 8 fathoms, about a mile wide.

Flat reef is a patch of rock, steep-to, and lies midway between the north point of Dragon shoal and the land to the north-west. It may be passed on either side, but the eastern is the one recommended. The channel between it and the north end of Dragon shoal is 4 cables in width.

A beacon consisting of an iron tripod with drum, painted red, is placed at the southern end of Flat reef, to mark it when covered at high water.

Kyangyaung point is a bluff on the western shore, 8 miles from the entrance of Ramree harbour, and has an islet lying half a mile distant from it; and a rock, nearly awash at low water, one third of a mile north-eastward of its northern part. After passing Flat reef, do not bring this islet to the northward of N. by W. It is steep-to on its eastern side.

Oyster reef which covers at high-water spring tides, lies 3 miles N. by W. from Kyangyaung point, with the sunken Cutters rock a mile farther north in the same line. For 5 miles N. by W. of these, a ship will carry $3\frac{1}{4}$ to 4 fathoms, but the channel is much narrowed by mud banks.

Wembaik creek running to the north-west from here, gives a short route to Kyauk Pyu, and can be navigated by small steamers of 6 to 8 feet draught.

Ramree river has its entrance 8 miles north of Kyangyaung point. Vessels drawing 9 feet can get up within $1\frac{1}{2}$ miles of Ramree town at ordinary high water. The entrance to Ramree harbour east of Sagu island is filled with mud and sand banks, through which, there are some narrow, tortuous channels, only fit for fishing boats.

Magyigyun is an island $2\frac{1}{4}$ miles long E.S.E. and W.N.W., and lies 2 miles south of Sagu island. This island is 270 feet high whale-backed, and stands in the centre of a shoal bank 5 miles long; off its west point lies the small islet, Tangagy ochaung, and the western end of the shoal bank is one mile west of this islet. Another small islet, Nyaungbinchaung, lies one mile S.W. of the centre of Magyigyun island, and marks the south-west edge of the shoal bank.

Gungasager rocks, a dangerous patch, 3 feet in height, lie 10 miles S.E. from Magyigyun. Vessels can pass a mile to southward of the dry rocks.

Osprey rocks, 8 feet high, and nearly midway between Magyigyun and Gungasager rocks, form another dangerous group. A third group, the Pandaw rocks, extend off an island of the same name, which lies 5 miles to the northward of Gungasager rocks.

DIRECTIONS.—Vessels proceeding to Ramree harbour from the south-east, should pass south-westward of Gungasager and Osprey rocks and at least 2 miles westward of Magyigyun island, and make for the Gates, the entrance north-west of Sagu island. Steer through N.E. $\frac{3}{4}$ E. in mid-channel, till the north point of Sagu island bears S.S.E.; then steer N. by E. $\frac{1}{4}$ E. taking care not to bring the north point of Sagu westward of S. $\frac{1}{2}$ W., until about a mile from Flat reef beacon, when course may be altered to pass southward of Flat reef at 2 cables distance; the islet off Kyangyaung point should be given a berth of half a mile.

Tides.—It is high water, full and change, at a position 3 miles northward of Sagu island in Ramree harbour, at 9h. 10m. Springs rise 11 feet, and neaps 8 feet. At the south entrance to Wembaik creek at 9h. 50m. Springs rise $12\frac{1}{2}$ feet, and neaps 9 feet. The flood stream sets to the north, and ebb to the south; at springs, as much as 3 knots, and in the entrance to Ramree harbour 3 to 4 knots.

Kayaing creek, the entrance to which is about 12 miles south-eastward of the entrance to Ramree harbour, in its north-east arm, represents a part of the route to Taungup from Sandoway. This creek narrows to less than a cable, and within a mile of Taungup to about 50 feet, and is barely navigable by a steam launch.

The coast from the entrance to Kayaing creek trends in a S.S.E. direction in the form of long low islands for about 12 miles to Singaung, on the north side of entrance to Sandoway river.

Tides.—It is high water, full and change, at Singaung island at 9h. 28m. Springs rise 9 feet and neaps $6\frac{1}{2}$ feet.

DANGERS TO SOUTHWARD.—South-eastward from Flat and Hill islands, off the south coast of Chedúba, distant about 4 miles, and separated from them by a navigable channel 12 to 5 fathoms deep, known as the Heywood channel, is a line of reefs and a large rock, lying in the direction of S.S.W. and N.N.E.

West shoal, the southernmost danger, is a quarter of a mile across, and does not always break; at low water the points of the rocks are seen between the rollers. It lies S.S.E. $\frac{3}{4}$ E., 5 miles from Hill island, and has 12 and 14 fathoms close to it. Hill island bearing northward of N.N.W. leads westward of it.

Sail rock, $2\frac{3}{4}$ miles N.E. $\frac{3}{4}$ N. from West shoal, and nearly 5 miles S.E. by E. $\frac{1}{2}$ E. from Hill island, has 5 to 8 fathoms a quarter of a mile from it. Vessels should give this rock a berth of half a mile, to avoid possible sunken rocks that may have escaped the surveyor's attention. When West shoal is breaking, Childers channel, east of the above rocks, is a good one. Round West shoal at the distance of a mile, and steer N.E. $\frac{1}{4}$ E., passing 2 miles westward of East reef.

Heywood channel is not recommended.

False rock, is distant 5 miles N. by E. $\frac{3}{4}$ E. from Sail rock, and $6\frac{1}{2}$ miles E. by N. $\frac{3}{4}$ N. from Hill island. It is a solitary rock 10 feet high, joined to Sail rock by a bank of shoals. There are 8 fathoms half a mile east of it, and 4 fathoms three-quarters of a mile N.N.W. of it.

There is no safe passage between Sail and False rocks, and this part is strewn with rocks.

Unguan or Tree island is three-quarters of a mile long. It is distant 11 miles S.E. $\frac{1}{4}$ S. from Hill island, and has a dense clump of trees on its summit, which is 130 feet high. A reef of

straggling rocks extends one mile S.E. from the south point, and foul ground half a mile N.E. of its north point, and the same distance N.W. of it.

East reef, three-quarters of a mile long, dries at half tide, and lies $4\frac{1}{4}$ miles N. by E. of Unguan island. It has 6 to 8 fathoms round it. Cutter's patch, a small shoal, on which the least depth is $2\frac{1}{2}$ fathoms, rock, lies $2\frac{1}{4}$ miles N. by W. $\frac{1}{2}$ W. from Unguan island. The channel between Unguan or Tree island and Nerbudda shoal is $3\frac{1}{4}$ miles wide, and is the one chiefly used by strangers, owing to Unguan island being easy to make.

Nerbudda shoal, 6 miles long, N.E. and S.W., is a bank with a general depth of 6 to 10 fathoms, having several shoal heads upon it, and as little as $1\frac{1}{2}$ fathoms at its north-western point, S.E. by E. $\frac{3}{4}$ E., $4\frac{3}{4}$ miles from Unguan island centre. The south-western end, having $2\frac{1}{4}$ fathoms, bears S.S.E. $5\frac{1}{2}$ miles from Unguan island; and there is a depth of 3 fathoms in the centre of the shoal, N.E. $\frac{1}{2}$ E. 3 miles from the south-west end. The channel between this and Unguan island appears clear of danger, but Unguan island should be kept bearing north of N. by W. until within 3 miles of it, when a ship may steer to the N.E. or for Sandoway.

Tides.—It is high water, full and change, at Searle point, the north point of Chedúba island, at 9h. 15m., springs rise 10 feet, and neaps 7 feet.

The tidal streams on the Arakan coast setting to the northward during the flood, and to the southward during the ebb, are much influenced by the immense tidal tracts of backwater. The northerly stream is much affected therefore by local indraughts, though the southerly stream is but little altered by the outflows. There are no violent tidal streams between Kyauk Pyu and Sandoway, but at the entrance, into Ramree harbour, at springs, a 3 to 4 knot tide will be found.

SANDOWAY, Thandwai (iron bound), is a district in the south of the Arakan division, 3,667 square miles in extent. The face of the country is mountainous, the Arakan Yoma range sending out spurs which reach down to the coast, these again throwing out a number of side spurs parallel to the Yoma or main range, the whole drained by many small streams. From the mouth of the Sandoway river northwards, the coast is indented by numerous creeks, navigable by large country boats; which go almost the whole way from Kyauk Pyu to Taungup by backwater, the passage

taking about four days; there is also backwater communication between Taungup and the town of Sandoway. None of the boats are built for sea work, and the natives are ignorant of any method of landing from a boat in the surf. To the southward, the shore presents a rugged surface with few places of shelter. The rivers draining the country are but mountain torrents to within a few miles of the coast.

Sandoway River flows past the town of that name and flows into the sea at Singaung, about 10 miles to the north-west. The influence of the tide is felt a short distance above Sandoway town. The river is navigable by large boats; and small steamers of from 6 to 8 feet draught can proceed at ordinary high water to within 3 or 4 miles of the town.

B. I. steam vessels carrying the mail from Calcutta and Rangoon call off the entrance to the Sandoway river, except during the south-west monsoon, when the mails are brought from Kyauk Pyu viâ Taungup, by backwater. There is no trade, except a coasting one by backwater, carried on in small boats unfitted to put to sea. Whenever the wind is to the westward of north, a heavy surf breaks along the coast, making the landing in boats hazardous.

Gwataung,* 610 feet high, formerly called on the charts Sandoway peak, is a good landmark for making the anchorage both from the northward and southward; it is the only hill of any considerable elevation on this part of the coast, and is recognisable from positions both north and south of the Drunken Sailor rock. At the north-west extreme of Gwataung is a headland called Zalattaung, which forms the south side of entrance to the river. The north side of entrance is formed by a dry sand spit, off which shoal water extends out to the Drunken Sailor rock. The channel to enter by, for large boats, is close to the Zalattaung shore.

Drunken Sailor rock is a patch, 6 cables long, the southern end of which lies one mile W. by N. $\frac{1}{4}$ N. of Zalattaung; the shoalest portion nearly dries at low water, and at that time has nearly always a break on it. During the north-east monsoon a red conical buoy with basket, is moored on the south side of the shoalest water. This buoy is liable to be washed away.

DIRECTIONS.—From the buoy on the south side of the Drunken Sailor rock steer for the Rest house, about E. by N., until Zalattaung

* Sandoway high land appears like three islands when viewed from the south and westward, but when approached from Chedúba strait the three seem one island.

bears South, this will clear the outlying rocks, and then haul to the southward to pass round the sand spit of Singaung, between this spit and Zalattaung is a small depression with from $2\frac{1}{2}$ to 6 fathoms in it.

A steam launch drawing 3 feet can ascend the river to Sandoway with the flood; reaching Kinmaw, a large village, at nearly low water, and from thence a road will be found that leads to the town, a distance of 5 miles.

Anchorage.—Vessels can anchor in about 6 fathoms, mud, to the northward of the Drunken Sailor rock, with the Rest house on the sand spit bearing E.S.E., and a remarkable tufted clump of trees, on the coast, 2 miles farther north, bearing E.N.E.

Steam vessels of the B. I. Co. visiting the port, anchor to the southward of the Drunken Sailor rock; this anchorage is good in the north-east monsoon, but in the south-west monsoon it is exposed and dangerous. A detached rock above water lies 6 cables south of Zalattaung point, and there is foul ground round it. In the south-west monsoon the port is considered closed.

Tides.—It is high water, full and change, at the mouth of the Sandoway river at 9h. 28m. Springs rise 9 feet, and neaps $6\frac{1}{2}$ feet.

Climate.—There are three seasons which follow each other with regularity, but with occasional variation in duration, and time of commencement.

The cold season from November to February, when the dews are exceedingly heavy and the nights chilly, the winds light, usually at first from north-west and north-east, gradually veering round to west and east. From February to May, dense fogs rise during the evenings and mornings, and the wind comes from the west. Towards the middle of May, storms of thunder and lightning, with squally weather, and south-east and south-west winds usher in the rainy or warm season (which ends about October), with still more violent atmospheric disturbances and strong winds blowing from the south and south-west, gradually becoming variable, till, toward the end of October they settle, and the cold weather begins.

The Population of the Sandoway district in 1872 was 54,725, and in 1877 the inhabitants of the town of Sandoway numbered 1,617.

Trade consists chiefly in the export to Akyab and Kyauk Pyu of rice, tobacco, sessamum, plantains, betel leaf, salt (made by boiling, and partly by solar evaporation), salt fish, fish paste, dhaní leaves for thatching, and boat building.

The import trade consists of piece goods, twist, betel nut, crockery, and hardware, and various articles for domestic use.

THE COAST from Gwataung hill is low and sandy, and trends S.E. by S. for 9 miles to Apau ye, a bluff islet with a bay to the north of it which is foul. A deep bay* not yet examined, lies E.S.E. of Apau ye. This coast should not be closed within 4 miles, and then with caution.

Southward of the unsurveyed bay just alluded to, the coast forms a considerable promontory nearly 5 miles in length north and south on its seaward face, off which, foul ground apparently extends for about $2\frac{1}{2}$ miles. It then recedes for a distance of $6\frac{1}{2}$ miles, and sweeps to the southward for 16 miles, forming a bight, in the south part of which the Kyein ta li river which separates the province of Arakan from that of Pegu, enters the sea. The small rivers of Kamyit and Salu enter the sea at distances of about 12 and 10 miles respectively, to the north of the mouth of the Kyein ta li river.

Carpenter shoal, formerly known as Four-fathom shoal, has an area of about 2 miles square, with general depths of 7 to 10 fathoms on it. The least depth on it is 10 feet, bottom large stones, situated northward of the centre of the shoal, and S.E. $\frac{1}{2}$ S. 14 miles from Unguan island.

FOUL ISLAND, nearly 2 miles in length north-east and south-west, and about 500 feet in height, bears from Unguan island S.S.E. $\frac{1}{2}$ E., 26 miles. On its north side is a bank of sand and mud, said to afford anchorage at the distance of half a mile from the shore, in 8 and 10 fathoms. In fine weather, Foul island is visible for a distance of about 30 miles.

Brougham shoal, nearly awash, $3\frac{1}{4}$ miles N. by E. from Foul island north-east point, is a patch of rock, half a mile long, on which the sea breaks. It should be avoided.

Vestal shoal, also nearly awash, bears from the north-east point of Foul island E. by S. $\frac{1}{2}$ S., $5\frac{1}{2}$ miles. It is small, with breakers constantly on it, and 20 fathoms of water around it.

William shoal, on which is a depth of 3 fathoms rocky bottom, bears from the north-east point of Foul island E. by S. $\frac{1}{2}$ S., 12 miles.

* Sometimes termed Andrew bay, and said to afford good anchorage, protected from south-west winds by a reef which projects from its southern point.

Satellite rock* upon which the sea was reported to have been seen to break, has a doubtful position 5 miles N. $\frac{1}{4}$ W. of William shoal, or about 12 miles E. by N. of Foul island.

Caution.—Vessels proceeding eastward of Foul island are recommended to pass within 3 miles of it, to ensure their clearing the Vestal, William, and Satellite shoals.

The COAST from the mouth of the Kyein ta li river rises considerably, and trending to the westward for about $2\frac{1}{2}$ miles, turns sharply at right angles or to the southward, forming Bluff cape, a headland which is discernible for a considerable distance. From Bluff cape the coast trends S.S.E. for about 26 miles to Khwa or Gwa and should nowhere be closely approached. Reefs of unknown extent, and in close proximity to which is generally a depth of from 6 to 10 fathoms, line its projecting points. About midway there is a hill of peculiar form, known as Quoin hill, and farther inland are several peaks of considerable height. Rocky islet, opposite Quoin hill, and about a mile from the coast, is surrounded by reef, which extends from it upwards of a mile to the south-west.†

KHWA (Gwa) is a small town situated about a mile from the mouth of, and on the eastern bank of a river of the same name, which empties itself into the sea in about lat. $17^{\circ} 35' N$. Its mouth forms a small harbour, but the entrance is rendered difficult by a bar of sand on which at low water is a depth of $2\frac{1}{2}$ fathoms.

The town of Khwa is surrounded by a grove of fruit trees, the houses are generally good, and the roads broad and crossing at right angles. During the north-east monsoon a little trade is carried on by sea with the Bassein District to the south, and Chinese junks occasionally anchor off the village. The population, consisting almost entirely of Burmese, in 1877 amounted to 1,303.

Anchorage in Khwa bay outside the mouth of the river, may be had in from 4 to 6 fathoms, but is much exposed to westerly winds. In entering, it is necessary to guard against a reef of rocks which extend about three-quarters of a mile south of Rocky point (the north point of the bay).

Tides.—It is high water, full and change, at 11h. 30m. in Khwa bay; springs rise 6 feet.

Khwa (Gwa) island, situated southward of the entrance to Khwa bay and about $1\frac{1}{2}$ miles from the coast, is half a mile in extent,

* Searched for by H.M.S. *Childers* in 1859 for a week without success.

† Imray's Bay of Bengal Pilot, p. 113.

of moderate height, and affords an excellent mark for vessels bound to Khwa bay from the south-west. A rock having over it 2 fathoms is situated a mile N.N.E. of Khwa island, and as foul ground extends between the island and shore and also around the island, the channel eastward of the island should not be attempted.

St. John's or Church rocks are four in number, and cover the space of about a mile in a north-west and south-east direction. The largest, about 30 feet high, when seen from the north-east, resembles a church; it bears from Khwa island S.W. by W., 12 miles. A vessel passing outside them in the night should not shoal the water under 70 fathoms.

THE COAST from Khwa bay to abreast Koronge island in lat. $16^{\circ} 32' N.$, trends to the southward, and is irregular, rocky, and broken up into a series of unimportant bays, having little or no trade, and for details connected with which, the chart, though not perfect, is the best guide. In lat. $17^{\circ} 14' N.$ is Round hill, and another named Peak hill in lat. $17^{\circ} 10' N.$ High island lies closely tucked in to the shore in lat. $16^{\circ} 57' N.$, and Broken point in lat. $16^{\circ} 55' N.$ forms the west entrance of an open bay, into the upper part of which, the Kyaung tha river, a stream from 6 to 18 feet deep, flows. From the town of Kyaung tha, Bassein is distant about 20 miles in a south-east direction. Communication between the two towns is difficult, being by road over a mountain pass, which is scarcely traversable after heavy rains.*

CALVENTURA ISLANDS (Huget taung) form two divisions off the coast near Broken point, bearing from each other north-west and south-east, distant 5 or 6 miles.

North-west group in about lat. $16^{\circ} 55' N.$, long. $94^{\circ} 13' E.$, consists of seven irregular black rocks, one of which, about 100 feet high, resembles an old church with a mutilated spire.† The south-east group consists of two rocky islands, North and South islands, covered with vegetation, the southern of which is low and wooded, and connected by a reef with from 5 to 7 fathoms of water upon it. About half-way between the two islands of the south-east group is a rock which dries at low water.

Mile Stone rock is high and black, in lat. $16^{\circ} 40' N.$, and distant about 3 miles from the coast between the Calventura and Koronge

* Imray's Bay of Bengal Pilot, p. 114.

† No soundings are shown between the Calventura islands and North-west group; in old charts breakers are inserted between, with North Calventura island bearing E. $\frac{1}{2}$ S. distant $2\frac{1}{2}$ miles.

islands. Close to, on all sides, the Mile Stone rock has depths of 13 fathoms, and between it and the coast to the south-east are several reefs, some of which are above water.

KORONGE ISLAND,* the north point of which is 7 miles S. by W. $\frac{1}{2}$ W. from Mile Stone rock, is about $2\frac{1}{2}$ miles in length, high, and appears rugged, especially when seen from the northward. It tapers to a point at its northern end, and lies about a mile distant from a cape, which has a bay to the northward of it. The channel eastward of the island is contracted by a shoal extending half way over from this point. This channel has a depth of 4 fathoms as shown by the chart, but it is imperfectly known, and should not be attempted by strangers.

Crawford shoal partly dry at low water spring tides, bears S.W. $\frac{1}{2}$ S., distant $3\frac{1}{4}$ miles from the south end of Koronge island. It has 15 to 18 fathoms close outside it.

THE COAST from abreast Koronge island to cape Negrais trends about S. by W. and S.S.W., is rocky, and has some projections and indentations, with a few scattered islets and reefs extending from one to 3 miles off it, of which the Crawford shoal, just described, is the most dangerous, and farthest from the shore. Conical cape is $3\frac{3}{4}$ miles eastward of Crawford shoal, and has White rock half-a-mile off it.

Saingbain Kieu, or Buffalo rocks, the north end of which bears S. $\frac{3}{4}$ W., 6 miles from the south point of Koronge island, extend about 7 miles in a N.N.E. and S.S.W. direction. They are isolated and high, several of them being white, the two outer and south-western being termed the North and South Buffalo. To the southward of these the coast becomes more clear, and the mountain range which divides the coast from the Pegu district, approaches the coast. It is high and rugged, and broken into cliffs of reddish earth in many places, but without signs of cultivation.

Round capé, about midway between Koronge island and cape Negrais, bears S.E. by S., 4 miles from South Buffalo, and has an islet off its south-west side, and a depth of 4 fathoms at the distance of a mile north-west of it. Bearing from Round cape S.S.W. $\frac{1}{2}$ W. $5\frac{1}{2}$ miles, is Black rock, which is dark and easily distinguished; it lies a little more than 2 miles from the shore. On the ridge, about 4 miles south-eastward of Round cape, is Conical mountain. Passing

* See Admiralty chart No. 823, Koronge island to White point.

vessels should keep well to the westward of all the islands and rocks lying off this part of the coast.

CAPE NEGRAIS, the south-west extreme of Burma, is rather prominent. It has a rocky knoll on its extremity, about 40 feet high, and from the back of that it rises gradually to a height of 630 feet, where it joins the Yoma range of hills, running north and south along the whole west coast of Burma. From cape Negrais to Mawdeng (Pagoda point) there is a succession of low hills, mostly densely wooded, but towards Mawdeng there are some remarkable bare reddish slopes of blown sand on the hills, which then shew a well defined edge of dark foliage near their summits. A reef skirts this coast, and there are many dangerous outlying rocks, so that the land south of cape Negrais should not be approached nearer than 3 miles, and then with caution.

Directions.—In beating round cape Negrais, a vessel may shoal to about 10 fathoms, and stand off to 18 or 20 fathoms. In sailing northward, especially at night, it is desirable to keep a good offing, frequently using the lead, and passing outside the various rocks which have been described. From the proximity of the mountains, the winds are baffling during the north-east monsoon, and in the south-west monsoon the weather is bad, so that the plan recommended in Horsburgh of working up inshore has been abandoned. Should it be deemed advisable to do so, it is best to keep in soundings proper for anchorage, and avail yourself of the alternating land and sea breezes, and the uncertain currents.*

SOUNDINGS.—The soundings northward of the parallel of cape Negrais are scarce. Neither the 10, 20, nor 100 fathom lines have yet been properly determined, the last apparently extends to a distance of about 25 miles westward of the cape.

Juanita shoal.—Commander Harrington sounded in the U.S. vessel-of-war *Juanita*, in 25 fathoms, bottom coral and broken shells, in lat. $15^{\circ} 58' N.$, long. $93^{\circ} 43' E.$, or 27 miles W. by S. of cape Negrais, indicating that uneven ground may exist in the vicinity.

* Findlay's Indian Ocean Directory, 4th edition, p. 1115.

CHAPTER VII

ACHEH HEAD (N.W. COAST OF SUMATRA) TO TABLE ISLAND (COCO GROUP); INCLUDING NICOBAR AND ANDAMAN ISLANDS.

VARIATION 2° E. IN 1892.

Having now come to the chain of islands occupying the south-eastern part of the bay of Bengal, a description of them will be given; beginning with the northern point of Sumatra, and working to the northward, so as to continue the remarks on the coast of the mainland at cape Negrais, where they are now broken off, in the same direction as in previous chapters.

PULO RONDO,* or Tepurong, is the northernmost of the islands lying off Acheh head, the north-west point of Sumatra, from which it is distant about 30 miles. The island is 426 feet high, dark-coloured, 2 cables in diameter, and steep-to; rocky islets from 80 to 150 feet high extend to the distance of one mile from its south side.

PULO BRAS, situated about 20 miles southward of Pulo Rondo, is the westernmost of the islands off Acheh head; it is $8\frac{1}{2}$ miles long in a north-west and south-east direction, and attains a height of 2,296 feet.

Off the north end of Pulo Bras are four rocky islets, the northern (N.W. islet) is 25 feet high and about $4\frac{1}{4}$ miles distant, with soundings of 25 to 30 fathoms within one mile. The other islets lie within one mile of Pulo Bras, and the sea breaks heavily on them even in moderate weather. There is a passage between the N.W. islet and the inner islets, but vessels are recommended to pass outside them all.

Depths of 15 to 20 fathoms, sand, will be found within one mile of the north-east side of Pulo Bras, where vessels may find temporary anchorage.

Fleurs rock, a small rock having a depth of about 6 feet, lies about $1\frac{3}{4}$ miles from the west point of Pulo Bras, and nearly in line with two small rocks above water, off the north point of that island. The water in the vicinity of the rock is discoloured, and breaks when there is any wind.

* See Admiralty chart, No. 219, Acheh head to Diamond point.

LIGHTS.—On Willemstoren the north-east point of Pulo Bras, stands a tower, 147 feet high, painted white to a height of 98 feet and red the remainder; from the tower is exhibited at an elevation of 525 feet above the sea a *revolving white* light which attains its greatest brilliancy *every minute*; the light is visible between the bearings of E. $\frac{3}{4}$ N. (through south and west) and N.W. $\frac{1}{2}$ W. and in clear weather should be seen from a distance of 30 miles; within a distance of 12 miles a faint continuous light is seen. North-eastward of Pulo Wai, the light is obscured by that island.

From the same tower, at a height of 26 feet above the ground, and 433 feet above the sea, is exhibited a *fixed red* light, visible between the bearings of S. by E. $\frac{1}{2}$ E. and E. by N. $\frac{1}{2}$ N. or over North-west islet; this red light is intended to warn vessels of their approach to North-west islet, and in clear weather should be visible from a distance of 8 to 12 miles.

Position.—Pulo Bras lighthouse is situated in lat. $5^{\circ} 45' N.$, long. $95^{\circ} 4\frac{1}{4}' E.$ (approximate).

Lembalei bay, on the north-east side of Pulo Bras, is about $1\frac{1}{2}$ miles broad, half a mile deep, and has 19 fathoms water on a line joining the entrance points, thence shoaling gradually to the shore. There is anchorage in the north-west part in 9 fathoms, 3 cables distant from the village.*

Coal may be obtained here from the Dutch Government dépôt. It is brought alongside in lighters. During the north-east monsoon a heavy sea sometimes sets into the bay, which renders it doubtful as to the time a vessel may have to wait to fill up with coal.

Communication.—The Netherlands India Company's steamers call monthly.

Pulo Nasi Besar nearly joins the south-east point of Pulo Bras, being separated by a narrow rocky channel of irregular depth, in which the tides run with great strength. Pulo Nasi is saddle-shaped, and about 4 miles long north and south; its south-east point is skirted by rocks.

There is anchorage in 6 to 10 fathoms in the bay on the south side of Pulo Nasi, about $1\frac{1}{4}$ miles eastward of the south-west point. Fresh water and firewood may be procured on the west side of the bay.

Rots bay, on the north-east side of Pulo Nasi, is about 4 cables broad, 4 cables deep, with a shallow rocky patch 2 cables off shore

* See plan on Admiralty chart, No. 219; scale, $m = 3$ inches.

near its head. It affords anchorage in 6 fathoms at 3 cables from the shore. Off the south point of the bay is Rots island, small and nearly circular.*

Balken bay is situated on the west side of Pulo Bras, abreast Lembalei bay; it has depths of 7 to 12 fathoms, but is exposed to the south-west monsoon.

Merdoc peak, a conspicuous dome-shaped peak, in Pulo Wai, seen through the valley behind Sand bay (the southern part of Balken bay), bearing N. 74° E., leads into Balken bay, and 2 cables southward of Sidom or Pijlmer rock, which lies half a mile south-west of the west point of the bay.†

Pulo Nasi Kechil (Middle island) lies about three-quarters of a mile off the south-west end of Pulo Bras; off its south side, at one mile distant, is a group of islets, with from 9 to 15 fathoms water between them and Pulo Nasi Besar.

Pulo Kelapa or Bunta (Gomez) is about 2 miles in length, and lies between Cedar and Surat passages. Its western point is low, with islets and rocks off it; breakers extend about half a mile westward of the point. The south side of Pulo Kelapa is safe to approach.

Pulo Batu (Stony island) lies north-eastward of Pulo Kelapa.

SAWANG ARUS BESAR (Cedar passage) is formed between Pulo Nasi Besar on the north, and Pulo Kelapa and Pulo Batu (Stony island) on the south.

Rocks.—About one mile S. $\frac{3}{4}$ W. from the south-west point of Nasi Besar, and in the approach to Cedar passage, is a dangerous rock which dries 7 feet at low water; and between this rock and a rock lying $1\frac{1}{2}$ cables from the island, there are depths of 10 to 16 fathoms, with similar depths southward of it. From the rock the south-west extreme of Nasi Kechil island is in line with the northern of the small islets south of Nasi Kechil island, bearing N.W. by W. $\frac{1}{4}$ W. About 3 miles eastward of this rock and about half-a-mile off shore, is another dangerous rock with 3 feet water, and depths of 6 and 8 fathoms close-to. From this rock, the south extreme of the islet off the west end of Pulo Batu is in line with a red mark in the cliff near King point.

* See plan on Admiralty chart, No. 219; scale, $m = 3$ inches.

† See plan of Balken and Sand bays on Admiralty chart, No. 219; scale, $m = 1.75$ inches.

A shoal of $4\frac{1}{2}$ fathoms lies midway between Pulo Batu and Pulo Kelapa, but out of the track of vessels through Cedar passage.*

DIRECTIONS.—The channel recommended is that southward of the rocks lying near the fairway, southward of Nasi Besar ; it is about one mile wide at its narrowest part, with from 15 to 20 fathoms water.

Cedar passage is much wider than Surat passage, more free from eddies, and safer for a sailing vessel proceeding to the westward with a foul wind, as she can drift with the tide under sail, taking care to avoid the rocks off Pulo Nasi, before mentioned. The north-west side of Pulo Batu is steep-to, and may be kept close onboard.

SAWANG ARUS KECHIL (Surat passage) is formed by Pulo Kelapa, Pulo Batu, and Pulo Angkasa on the north-west, and the promontory of Acheh on the south-east. Between Pulo Angkasa and Acheh head at the eastern end, the passage is only 150 yards wide, but the water is deep. Between Pulo Kelapa and Sumatra the passage is $1\frac{1}{2}$ miles wide with 12 to 17 fathoms water. Near the east side of Pulo Kelapa there is a rock above water, at one cable distant from the shore.

DIRECTIONS.—In approaching Surat passage from the south-west, no opening is perceived, the adjacent islands Kelapa, Nasi, and Bras appearing to join the mainland when seen from that direction. South-eastward of King point, at the distance of 5 miles, and on the south side of a low green point there is a sandy bay, named Krang Baba, which at a distance may be mistaken for Surat passage, the adjacent land being low near the sea, and covered with trees.

Steering for Surat passage, vessels should keep nearer to Acheh head than to the opposite side of the channel, as Acheh head is bold, with regular soundings of 12 to 14 fathoms, sand, at a moderate distance, and temporary anchorage may be found near the shore in from 7 to 10 fathoms. The south side of Pulo Kelapa island is also safe to approach, there being from 12 to 15 fathoms within half a mile of its south point. If the tide be unfavourable a sailing vessel should anchor near Acheh head until the flood stream makes ; the flood sets north-eastward directly through the passage, the ebb in the opposite direction, at the rate of 5 to 7 miles an hour at springs, in the

* The rocky patch of 4 fathoms, formerly shown on the charts, situated W. by S. 8 miles from the west end of Pulo Gomez, and the narrow ridge of soundings of 7 to 10 fathoms (possibly less), reported to extend 40 miles in a S. by E. $\frac{1}{2}$ E. direction from it, are said to have no existence.

narrowest part of the passage ; the eddies caused by the rapid tides render steering in this part very difficult for sailing vessels during light winds.

PULO WAI, the north-easternmost and largest of the islands off Aceh head, lies about 12 miles north-east of the head, and 10 miles south-east of Pulo Rondo. Pulo Wai is about 11 miles long, from 2 to 6 miles broad, and high and mountainous ; the summit being 2,200 feet above the sea, may be seen upwards of 50 miles in clear weather. It is steep-to in most places, there being no change in colour from the deep ocean blue of the water at 2 cables from the coast, but near the south side soundings may be obtained.

Berduri rock dries about 4 feet at low water ; and lies about three-quarters of a mile distant from the south point of Pulo Wai ; vessels should pass southward of the rock.

In **Balohan bay**, nearly 2 miles in length, on the south-east side of Pulo Wai, the water is very deep ; possibly anchorage may be obtained near its head, where there are depths of 15 to 20 fathoms close in. Fresh water may be procured at the head of the bay near a sandy beach. There is a sulphur mine in the vicinity.

Prialaut and Saban bays are situated in the deep bight on the north side of the island ; the latter has an almost land-locked harbour in its southern corner, partly formed by an island, with anchorage in 9 to 12 fathoms.*

Pulo Wai is under cultivation, and there are said to be 300 or 400 inhabitants on the island.

BENGAL PASSAGE, formed between Pulo Bras and Pulo Wai, is about 11 miles wide, and convenient for vessels sailing from Aceh head to the north-westward, as the current generally sets out in that direction, but sailing vessels bound into Aceh road seldom proceed through Bengal passage unless with a steady commanding breeze, there being no anchorage in the passage except near Pulo Bras. During the south-west monsoon, the current sets round Pulo Bras to the westward, frequently at the rate of one to 2 miles an hour.

ACHEH (ACHEEN) HEAD is a bluff promontory 1,675 feet high, forming the north-west extremity of Sumatra. At a considerable distance Aceh head appears like a steep hill, Pulo Gomez then resembles two paps, its western point being very low. King point

* See plan of Saban bay on Admiralty chart, No. 219 ; scale, $m = 2\cdot4$ inches.

(Ujong Rajah) is the south-west extremity of the promontory of Aceh head, and lies about 3 miles to the south-west of the head.

Tides.—It is high water, full and change, at Aceh head at 10h.; springs rise 5 feet, neaps $3\frac{1}{2}$ feet.

ACHEH (ACHEEN) BAY and RIVER.—Aceh bay is formed between the eastern part of Aceh head and the entrance of Aceh river.* The shores are low and wooded and skirted by a bank on which depths of 5 fathoms are found at from 5 to 7 cables from the shore. In the western part of the bay is Pulo Tuan, a small cone-shaped island joined to Aceh head by a rocky ridge 6 cables in length.

Maraksa river enters the sea between Pulo Tuan and the settlement of Olehléh.

Aceh river falls into the sea by several mouths, separating the low country into islands, which are inundated during the rainy season. The principal mouth, situated about $5\frac{1}{2}$ miles eastward of Aceh head, is about 100 yards wide, and has a depth of one foot on the bar at low water, and 6 feet at high water.

There is a pyramid beacon on the west point of entrance to the river, and a remarkable tree on the shore at $1\frac{1}{2}$ miles eastward of Olehléh.

Anchorage.—The usual anchorage is off the town of Olehléh, in from 4 to 5 fathoms, at about half a mile off shore. The holding ground is bad.

The anchorage off Aceh river is in from 7 to 9 fathoms, with the entrance bearing from S. $\frac{1}{2}$ E. to S.S.E., distant one mile. Eastward of this, the shore flat, with 3 fathoms on its outer edge, extends one mile off shore.

During the south-west monsoon, which prevails from May to October, a good scope of cable is necessary in these anchorages as the squalls are severe. During the north-east monsoon the winds are seldom strong, but north-west winds sometimes blow with great force through Bengal passage, and render the anchorage insecure. Land and sea breezes often blow during both seasons, but the land breezes do not extend beyond the islands. The bay is infested with sharks.

Directions.—Approaching Olehléh from the eastward, keep the perpendicular south fall of the hill $1\frac{1}{2}$ miles within Aceh head, in

* Aceh (Acheen) is spelt by the Dutch, Atjeh, which just gives the pronunciation. See plan of Aceh bay and river on Admiralty chart, No. 219; scale, *m* = 2 inches.

line with or open northward of Pulo Tuan, to clear the flats extending off Acheh river; this mark also leads northward of the 6-fathoms patch situated 2 miles off shore eastward of the river. There are no other known dangers in the approach. From the westward there are no dangers seaward of Pulo Tuan.

Kota Raja, the Dutch capital of Acheh, is situated on both banks of Acheh river, and connected by a wooden bridge, situate about 3 miles from the entrance. The Dutch governor resides here.

OLEHLÉH, situated on the shore of Acheh bay, is connected with Kota Raja by a railway $3\frac{1}{2}$ miles in length.

Piers.—There are three landing piers and two or more flagstaffs. The westernmost pier is fitted with two steam cranes and connected by a double line of rails with the railway.

Light.—A *red* light is exhibited from the westernmost or Government pier at Olehléh.

Supplies.—Fresh beef, poultry, vegetables, bread and water, are to be obtained, and fruit when in season.

Coal.—There is a contractor at Olehléh who possibly may be able to supply coal. The Dutch coaling station is in Lembalei bay, *see* page 259.

Trade.—The exports are pepper, betelnuts, gutta percha, and other gums, rattans, and cocoanuts. The imports are cattle (from India), haberdashery, and all descriptions of provisions. Most of the exports and imports on the north coast are collected and distributed at Olehléh.

In 1883, the exports, principally pepper and betelnuts, amounted to £31,000; the imports to £265,000, a large portion of the latter being for the Dutch troops stationed there.

For the northern ports of Acheh; the exports and imports for Segli (about 50 miles eastward of Olehléh) were £45,000 and £54,000; Salamanga, £5,600 and £13,000; and Telok Samoi, £35,000 and £35,000; conducted principally by schooners.

Shipping.—In 1884, 189 Dutch steamers visited Olehléh, and 14 English; 19 sailing vessels also entered and cleared.

In 1883, the number of English steamers was 130; the falling off being caused by an order to convey all Government goods in Dutch vessels.

Communication.—The Netherlands India Company's vessels call every fortnight ; also at the principal Dutch ports in Sumatra ; at others once a month. Steamers also trade with Penang.

MALACCA PASSAGE, formed between Pulo Wai and the Sumatra coast, is 7 miles broad, and the best channel when approaching Acheh from the northward.

Pulo Buru (Malora), is situated in Malacca passage at about $2\frac{1}{2}$ miles from the Sumatra coast. The islet is fringed by a reef to the distance of about 3 cables, beyond which there are no dangers.

LIGHT.—A *fixed white* light is exhibited on Pulo Buru from an iron standard painted white ; the light is elevated 62 feet above high water, and visible in clear weather from a distance of 12 miles.

A bank of 6 fathoms lies 2 miles off the Sumatra coast, with Pulo Buru N.N.E., 3 miles.

Tanjong Batu (Pedra point), the north point of Sumatra, is situated 13 miles E.N.E. from Acheh head, and may be approached to a distance of one mile. The point is low, terminating in a green slope with a few trees, and is fringed by a rocky shoal which extends a quarter of a mile seaward with depths of 6 to 7 fathoms at three-quarters of a mile from the point. A bluff formed by high land is situated $1\frac{1}{2}$ miles westward of Pedra point. The bottom in this vicinity is rocky, and moderate depths for anchorage will not be found beyond $1\frac{1}{2}$ or 2 miles off the coast.

BETWEEN PULO RONDO and GREAT NICOBAR ISLAND (the southern of the Nicobar group), is a channel about 90 miles wide, free from danger, in which are depths varying from 1,700 to 400 fathoms ; the bank with less than 100 fathoms on it. extends upwards of 20 miles southward of the south point of Great Nicobar.

NICOBAR ISLANDS.

About 90 miles north-west of Sumatra and south of the Andaman islands, or between lat. $6^{\circ} 40'$ N. and $9^{\circ} 20'$ N., and long. $92\frac{1}{2}^{\circ}$ E. and 94° E. the Nicobar islands extend in a N.N.W. direction. This group consists of 20 islands, of which the following are the principal, Great Nicobar, Little Nicobar, Kachal, Nankauri, Kamorta, Trinkat, Teressa, Bompoka, Chaura, Tilanchong, Batti Malv, and Kar Nicobar.

The first European station was formed by French Jesuits, who occupied one of the central islands in 1711, and were soon after killed by the natives. Afterwards the Danes, German Moravians, and Austrians, at various periods, attempted unsuccessfully the colonisation of the group. In 1869 the islands were finally annexed by the British, and placed under the jurisdiction of the Superintendent of the Andaman islands. The chief harbour is between the islands Nankauri and Kamorta.

The islands are all well wooded, those of the southern group, which are of calcareous sandstone formation, to their summits; the northern group have grassy summits, the woods being confined to the plutonic rocks at their bases, and the alluvium of the slopes and dells. Some of the islets are fringed with the cocoanut palm, while the sea cocoanut of the Seychelles flourishes in Kachál and other places. The Nicobars belong to an area of upheaval, and some of the hills seem to be of volcanic origin, but no lava formations were found, on examination, in the crater of the cone-shaped Bompoka. The coasts of the islands consist of coral sand, the bays being edged with coral reef.

The wild boar and buffalo roam over Kamorta; a species of deer is said to exist in Great Nicobar, where the dog has returned to a wild state. Apes, flying squirrels, and at least two species of venomous snakes, are also met with, besides two varieties of large saurians, and about forty species of birds.

Natives.—The natives are of light complexion, and above the average height, with the nose very broad, and the eyes slightly oblique. Tattooing is not practised, but the skull is artificially deformed as among the Flatheads of North America. There is no tribal government amongst them, society being kept together solely by a spirit of mutual reciprocity. There is no written language, and the dialects spoken differ so much that the inhabitants of one island can scarcely make themselves understood in another. They are said, as a rule, to be cowardly and treacherous; and in former years have repeatedly murdered the crews of vessels. There seems little doubt that many vessels supposed to have been lost in the bay of Bengal, have been cut off and plundered by the natives of the Nicobar islands. Their villages are generally built upon the beach, and consist of 15 or 20 houses, raised upon wooden pillars about 10 feet from the ground, they are round, and having no windows resemble bee hives covered with thatch, the entry being by ladder through a trap door. Each house contains about 20 people. Fishing is their chief occupation,

and their food consists of pigs, poultry, turtle, fish, cocoanuts, yams, and a bread made from the fruit of the *mellori* tree.

Products.—Since the British annexation of the islands, a penal station has been established in Kamorta, where much land has been gradually brought under cultivation, the clearings being occupied by many Hindu convicts. The principal product is the cocoanut palm, and its ripe nuts the chief export. Edible birds' nests, tortoise shell, ambergris, and trepang (sea slug) are also exported. The number of English and Malay vessels that trade to the Nicobar islands, is said to be increasing. In barter are used black, blue, and red cloths, handkerchiefs, cutlasses, Burmese *dáos*, spoons, spirits, tobacco, red woollen caps, &c.

CLIMATE.—Owing to the dense jungles the climate of the Nicobar islands is unhealthy, the prevailing disease being malarious fever, but a great improvement is said to have taken place in this respect where the land has been cleared. The average mean annual temperature is about 82·5° F., the maximum in the shade between 93° and 94° F., and the minimum 73° F. The barometer fluctuates between 30·163 and 29·708 inches; the mean annual range being ·238. More rain falls in the northern than in the southern group of the islands; the heavy rains occur in May, June, July, when the south-west monsoon is at its height, and the rains rarely cease before the end of December; March is the driest month; the total annual rainfall is about 100 inches. The seasons of the monsoons are not so well defined amongst the Nicobar islands as on the coasts of the bay of Bengal generally.

WINDS.—The prevailing winds amongst the Nicobar islands, are the monsoons, the south-west from the beginning of May to the middle of October; the winds are then variable until the end of the year; the north-east monsoon usually prevailing from January until April, with an interval of variable winds before the south-west monsoon begins. The hurricanes of the bay of Bengal seldom visit the Nicobars; they seem to originate nearer the Andaman islands, or towards the west coast of Sumatra, proceeding in the former case towards the northern portions of the bay, and in the latter towards the Coromandel coast and Ceylon. During the south-west monsoon, frequent thunderstorms and gales of wind occur, especially in the vicinity of Great Nicobar island. The north-east monsoon brings fine weather, and sometimes blows with considerable strength.

Tides and Currents.—In the immediate neighbourhood of Nicobar islands a vessel will probably be influenced by the tidal

streams, the flood setting generally to the north-east and ebb to the south-west, and attaining a velocity of 3 to 4 knots in the channels between the islands. In the offing the surface drift is affected by the prevailing monsoon, but is uncertain in strength, and irregular in direction. Between the Nicobar islands and Junkseylon, a strong north-west current has at times been experienced, sometimes setting north. On the other hand, between Great Nicobar island and Acheh head of Sumatra, H.M.S. *Rifleman* in August 1878 experienced a south-west set of 2 knots an hour, the wind at the time being south-east force 2 to 3. In February 1882, H.M.S. *Alert* experienced a current to the westward between Great Nicobar island and the north coast of Sumatra of as much as 59 miles in the 24 hours.

The time of high water, full and change, at Kar Nicobar is 9h. 40m., and at the entrance to Malacca strait 5h. 30m. The rise of tide at Kar Nicobar is 5 feet, and at the entrance to Malacca strait 15 feet, clearly denoting tidal irregularities, which may assist to account for the frequent tide rips met with. H.M.S. *Alert*, in February 1882 between Malacca strait and Nicobar islands passed through lines of heavy overfalls, about 3 to 5 miles apart; these occasionally had the appearance of breakers upon the weather side of a reef.

GREAT NICOBAR (Sambelong)* is the southernmost and the largest of the islands of the Nicobar group, extending for about 30 miles north and south, with a breadth of from 7 to 14 miles. The highest part of the island is that to the north, where the highest mountain attains an altitude of 2,105 feet. Near the centre a range of hills 1,333 feet high, extends in an E.N.E. direction across the island. To the southward, there is more high land, but not so much elevated. Almost the whole island is thickly covered with trees, and the soil is of great fertility. The western side of the island, exposed to the full force of the south-west monsoon, has not been examined. The natives of the interior are believed to be a different race to those of the coast.

South bay† (Galathea) at the south end of Great Nicobar island is an indentation 2 or 3 miles in extent, where there is fair anchorage during the north-east monsoon in from 9 to 16 fathoms; but its climate cannot be recommended, as owing to the position and shape of the bay it is excessively hot. A small river, navigable for a considerable distance by boats, empties itself into the head of the bay, but a sand bar closes its mouth at low water. Upon passing the south,

* See Admiralty chart, Nicobar islands, No. 840.

† See plan of South bay, scale, $m = 1.27$ inches, on Admiralty chart, No. 840.

or Parsons point, off which the surf breaks heavily, a remarkably flat island named Walker, resembling a fort with sentries posted round, will be seen on the west side of the bay, about 9 cables northward of Parsons point.

Landing may be effected by canoes at a gap in the reef about $1\frac{1}{4}$ miles northward of Walker island; and at a similar gap, on the east side of the bay, half a mile northward of Kwantung point.

The East Coast of Great Nicobar island northward of South bay, is imperfectly known; it appears indented in parts, and probably contains anchorages available during the south-west monsoon, when smooth water will be found on this side of the island. At about 12 miles northward of South bay, and 2 miles from the shore, is Boat rock, with three smaller rocks to the south-west of it, in the approach to a deep bight.

Trinkut Champlong bay* is small, and situated about a mile from the extreme north-east point of Great Nicobar island. It affords a safe anchorage in the south-west monsoon in from 10 to 7 fathoms, half a mile off shore. On entering the bay the water shoals suddenly from 22 to 10 fathoms, but thence to the shore the soundings decrease regularly. A vessel should not go nearer to the shore than in 6 fathoms. Great Nicobar island on this, the east side, is hilly and wooded to the water's edge.

A shoal, which has a depth of 15 feet on it, has been reported to lie about $1\frac{1}{4}$ miles N.E. of Murray point, the northern head of Trinkut Champlong bay.

Kabra, a small island, 309 feet in height, is nearly 3 miles northward of Murray point.

Ganges harbour* on the west side of the north-east point of Great Nicobar island, affords anchorage in from 9 to 16 fathoms, coarse sand and clay. In the entrance to the harbour is a bank, forming a middle ground, upon which are two rocks about 3 feet under water. Shoal water extends nearly a mile to the westward from the eastern entrance point of the harbour. On each side of the middle ground, in the entrance leading into the harbour, are depths of 17 to 27 fathoms.

Kondul harbour.†—Westward of Ganges harbour and near the north-west point of Great Nicobar island, is Kondul harbour,

* Remark Book of Nav. Lieutenant E. D. Phillips, H.M.S. *Wasp*, 1867.

† See plan of St. George's channel, on Admiralty chart, No. 840; scale, $m = 0.6$ inches.

protected to the northward by Kondul island, a rocky islet 2 miles in length, N.N.W. and S.S.E., with a hill near its centre, 400 feet high. Though the north side of this island is lofty and rocky, the east side affords secure landing. Vessels anchor here in 12 to 17 fathoms, sand and coral, at about midway between the island and the shore; or, they may anchor off the west side of the island in 10 to 12 fathoms, in each case selecting a position according to the direction of the prevailing wind. The anchorage of Kondul is airy, and distant from the mangrove swamps.

Caution.—The shores of Great Nicobar and of Kondul island should not be approached too closely, as other rocks may exist besides those shown on the chart. A bank, with depths of 7 to 8 fathoms, on which there may possibly be less water, extends 3 miles offshore, about 7 miles south-westward of Kondul island. The edge of the plateau on which the island of Great Nicobar stands, and which apparently extends a considerable distance from its coast, has not been determined.

St. George's Channel separates Great and Little Nicobar islands, and has deep water; but the tides which set fair in the direction of the channel, the flood to the north-east, and ebb to the south-west, are strong.

LITTLE NICOBAR ISLAND is 12 miles in length by about 8 miles in breadth, narrowing considerably towards its northern part. It is broken up into hilly ranges, the highest summit being mount Deoban, near the centre of the island, and elevated 1,428 feet. The whole island is thickly covered with swamp and forest. About a mile from its eastern side, and separated by a channel having a depth of 21 fathoms, is the small island of Menchál.

Meroe islet, which is low, and about a mile in length, bears W.N.W., nearly 11 miles from Sombrero point, the north point of Little Nicobar island, and the islets of Treis and Trak are distant respectively 4 miles and 5 miles from the same point, in about the same direction. There are sunken rocks near Treis and Trak islets; and midway between Treis, which has reef extending off it for a quarter of a mile, and point Sombrero, is a rock, having over it less than 6 feet of water. On the islet of Treis, the *Novara's* staff found pigeons in great variety. That vessel estimated that the tidal stream ran 5 knots at springs at her anchorage about a mile northward of Treis.

Pulo Milú off the north-west coast of Little Nicobar, is small. The channel eastward of Pulo Milú, or between it and

Little Nicobar, about 4 cables wide, forms a harbour, with depths varying from 9 to 13 fathoms, bottom sand and coral. This anchorage is accessible in all winds, and is well sheltered, but a considerable portion adjoining the shore of Little Nicobar is rendered useless by banks of coral. No water fit for drinking could be found by the *Novara*. The island of Pulo Milú, on which the screw pine grows in exceptional size and quantity, affords good landing on its eastern side. The natives are reported to be inoffensive and willing to trade, but are very poor, owing, probably, to the cocoa palm not growing so luxuriantly here as on Kar Nicobar and other islands of the group.

SOMBRERO CHANNEL, about 30 miles in width, separates Little Nicobar from the islands of Kachál and Nankauri. In it are the islets of Meroe, Treis, and Trak already described. A detached coral bank, with from 9 to 16 fathoms on it, is situated in the northern part of Sombrero channel, covering a space of about 7 miles in length, N.N.E. and S.S.W., by 4 miles in width, otherwise the water in the main part of the channel is deep. The tides set strongly in the Sombrero channel, N.W. and S.E., and are said to attain in parts, a velocity of as much as 5 knots at springs.

KACHAL bears N.W. by N. from Little Nicobar, the distance between their two nearest points being 30 miles. It is irregular in shape, about 11 miles in length N.W. and S.E., by from 7 to 2 miles in width. Deep bays indent its eastern and western sides; and its summit is elevated 835. It is covered with forest to the water's edge, and furnishes cocoanuts, ambergris, tortoise-shell, and edible birds' nests.

Anchorage on the south-west side of Kachál may be obtained in about 11 fathoms, off the entrance of the lagoon-like indentation on that side, but of an exposed nature. About 8 miles south-west of this anchorage is a depth of 12 fathoms, yellow clay, and other shoal ground may exist in the neighbourhood.

The bay on the east side of the island was visited by H.M.S. *Wasp* in 1869. A reef extends across the entrance, with only 4 fathoms water on it in places, deepening immediately within. The whole bay appeared to be dotted with rocky patches, the holding ground is indifferent, and it is exposed to the north-east monsoon. The *Wasp* anchored there, but the place cannot be recommended as an anchorage.

† See plan of Pulo Milú, scale $m = 2.4$ inches, on Admiralty chart, No. 840.

South bay, of Kachál, has rocks and foul ground in it, and should be avoided.

The channel between Kachál and Kamorta and Nankauri islands is apparently free from danger.

KAMORTA, the south coast of which forms the north side of Nankauri harbour, is 1½ miles in length, north and south, and generally 4 miles in width. The average elevation of the island is about 200 feet, but the summit of the southern part is 735 feet in height, and a hill in the middle of the island is 435 feet high. On both sides of the island, villages and huts are sprinkled along the coast. Kamorta bears a picturesque aspect, consequent on the alternations of forest and grass slopes, with the white coral beach crowned with cocoa palms. From the north-west point of the island, Perseus reef extends for nearly 3 miles in a north-west direction; in this vicinity is the village of Kéhul.

Expedition harbour.*—On the western side of Kamorta, 2¾ miles northward of its south point, is the entrance to Expedition harbour, a considerable land-locked bight, which runs in an easterly direction parallel to Nankauri harbour, from which it is separated by a low, narrow, irregular, peninsula. The numerous mangrove swamps render Expedition harbour an undesirable place to remain in for any length of time, and fresh water is scarce in quantity, and of doubtful quality.

The western part of Expedition harbour, was visited by H.M.S. *Wasp* in 1869, and it was remarked that the bay should be approached with extreme caution, more especially from the northward, as in that direction are several outlying dangers which only show at low water. Before entering, bring Edgcumbe point to bear N.E. ¾ E., and steer in with it on that bearing, passing Satellite point at the distance of a cable, and when Devil point bears North, steer for it, and anchor as convenient to the south of that point, in about 12 fathoms, soft mud.

A vessel should not proceed above Devil point, as the navigation is intricate, and the harbour has not been well surveyed further up.

A little fresh water may be obtained at the rivulet northward of Wasp point.

TRINKAT, singularly low and level, and abounding in cocoa palms, is 5 miles in length, north and south, by about one mile

* See Expedition harbour on Admiralty plan of Nankauri harbour, No. 841, scale, $m = 3.2$ inches.

in width. Near the centre, the island is nearly split in two by a deep indentation ; a village lies near the head of this inlet. Beresford channel between Trinkat and Kamorta is about a mile wide, but so far as is known it is almost blocked by reefs and sand banks.

Anchorage.—Vessels sometimes anchor in from 8 to 9 fathoms between the north point of Trinkat and the coast of Kamorta, but local knowledge would appear necessary, this part abounding in patches of coral rock.

NANKAURI ISLAND, the north coast of which forms the south shore of the harbour of the same name, is 6 miles in length, north and south, with an extreme breadth of $4\frac{1}{2}$ miles. It is 534 feet high, and thickly wooded ; off the south point, a reef of rocks, dry at low water, extends for about a mile to the southward.

Nankauri harbour, formed between the islands of Kamorta and Nankauri, is commodious and sheltered from all winds. Having two entrances, one from the east, and the other from the west, it can be entered or left without difficulty, in either monsoon. The western entrance is about a cable in width, and though narrower than the eastern, has the advantage of all dangers being visible. In 1869 Nankauri was made a penal settlement, subordinate to port Blair of the Andaman islands. The settlement is north-westward of Naval point, at the eastern entrance, and has a jetty nearly 400 feet in length. Supplies for the convict establishment are brought from Calcutta.

Buoys.—The eastern entrance is marked by two buoys ; a red conical buoy in $6\frac{1}{2}$ fathoms, marks the north-east extreme of the reef off Reid point, and a black conical buoy is placed outside the southern edge of the reef extending off Naval point.

DIRECTIONS.—**Western Entrance** may be identified as just to the southward of the highest hill on Kamorta ; also by Burleigh rock, which resembles a dog's head, situated a quarter of a mile south-westward of Indian point, the southern head of the entrance. The tides run strong between the points, and there are eddies, so that caution is necessary. A vessel should pass midway between Indian and Man points, then steer N.E. by N. up the harbour, edging to the northward as point Leda is approached, until Naval point bears E.N.E., when the latter may be steered for. This will lead midway between the reefs off Alfred and Leda points, and up to the anchorage westward of Naval point.

Eastern entrance is considered easier than the western, on account of its greater width. In entering, the red buoy off Reid point should be left on the port hand, and the black buoy off Naval point on the starboard hand.

Anchorage, Inner.—Nankauri harbour inside, opens out into four considerable bights, the two to the north known as Fort or Octavia and Satellite bays, the two to the south as Spiteful and Wasp bays.

The most convenient anchorage for trade is off the settlement, nearly 2 cables south-westward of the jetty, and 4 cables westward of Naval point.

Fort or Octavia bay, the easternmost of the northern bights alluded to, is clear and affords anchorage in its upper part in 11 fathoms.

Satellite bay is easy of entrance, but care should be taken if under sail to guard against the sudden changes of wind caused by the formation of the surrounding land. A detached patch of $2\frac{1}{4}$ fathoms, coral, with 5 fathoms around it, lies about 8 cables S.W. by W. of Alfred point. The *Wasp* anchored about 4 cables W. $\frac{1}{2}$ S. from Alfred point.

Wasp bay, the westernmost of the southern bights, is spacious and has general depths of from 18 to 21 fathoms. A rock, which covers at high water, lies $3\frac{1}{2}$ cables from the eastern shore of the bay, about one mile southward of Leda point.

Spiteful bay, the easternmost of the southern bights, is narrow and runs up in a S. by E. direction for $1\frac{1}{2}$ miles, terminating in an extensive mud bank, dry at half ebb. This bay should not be entered by a stranger unless the reefs have been previously buoyed. The most convenient anchorage is in the middle of the entrance to Spiteful bay, in about 12 fathoms, with Leda point W. by N. This position is open to the sea breeze.

Outer anchorage.—In the south-west monsoon vessels may anchor in False bay, north-eastward of Naval point. The holding ground here is said to be good, but a long scope of cable is necessary, as the squalls off the land are heavy.

Tides.—It is high water, full and change, in Nankauri harbour, at 9h. 15m. Springs rise 8 to $8\frac{1}{2}$ feet. The flood stream sets to the eastward, ebb to the westward; and in the entrances the stream attains considerable strength, though weak inside the harbour.

Supplies of pigs, fowls, yams, and cocoanuts, can be procured, and a small quantity of fresh water is procurable from a stream between Naval and Battery points.

Climate.—The following table is from observations taken at Nankauri at an elevation of 81 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range		Mean.	Cloud.	Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	80	86	77	9	13	75	5·2	2·9	8	29·86	·09
February - -	81	87	78	9	15	74	4·7	1·3	4	—86	·10
March - -	82	89	78	11	15	74	4·6	2·1	5	—84	·10
April - - -	83	89	79	10	17	76	5·3	5·3	9	—80	·10
May - - -	81	88	79	9	17	79	6·6	12·1	18	—77	·09
June - - -	80	87	78	9	16	82	7·3	12·7	22	—76	·08
July - - -	80	86	77	9	16	82	6·9	12·6	20	—77	·07
August - -	79	86	77	9	16	82	6·9	12·6	19	—78	·08
September - -	79	87	77	10	16	81	6·9	10·6	19	—80	·09
October - -	79	86	76	10	17	84	6·8	13·5	21	—81	·09
November - -	79	86	76	10	16	82	6·5	11·8	18	—82	·09
December - -	79	86	76	10	15	79	5·8	12·2	15	—84	·09

TILANCHONG, 10 miles in length, north and south, by less than a mile in width, rises at Maharani peak, nearly in the middle of the island, to 1,058 feet. The island is steep, with a jagged ridge, and its south point is N.N.E. 12 miles from the north point of Kamorta. Extending south-east from the south point of Tilanchong, for the distance of nearly 3 miles, is a chain of needle-like rocks, the highest of which, near the extremity, is termed Laouk (Isle of Man). Tilanchong is visited occasionally by the natives from Chaura and Bompoka.

Anchorage.—Castle bay on the south-east side of the island affords excellent anchorage during the greater part of the year, but is exposed to the south-east. The *Novara* anchored on the west side of Tilanchong in Novara bay.

TERESSA is 12 miles in length, north-west and south-east, by about $2\frac{1}{2}$ miles in width, and is distant about 12 miles to the north-west of Kamorta. It has a curved shape, the convex side facing to the westward. From a distance it appears like two islands,

the central part of the island being considerably lower than either the north or south part; its northern end has an elevation of 897 feet. Reefs extend from its north, west, and especially south-east parts, and it is not considered a desirable place to visit during the south-west monsoon. Anchorage may be had on its south-west side off a village called Hinám, and also on the eastern side abreast the north point of Bompoka island; but the water is deep and the anchoring position near the shore, in either case. Teressa has but few inhabitants.

Bompoka is $2\frac{3}{4}$ miles in length, north-west and south-east, by $1\frac{1}{2}$ miles in width, 634 feet high, and sparsely wooded. It is separated from the south-east part of Teressa by a channel, in which are soundings of 30 and 50 fathoms. The inhabitants are few.

Chaura lies 7 miles north-westward of the north point of Teressa. The island is generally low, but at its south end rises almost perpendicularly in a rocky pinnacle to a height of about 350 feet, having the appearance, with the contiguous low portion, of a flap hat. It was on this account termed *Sombrero* by the early Portuguese navigators, and the *Sombrero* channel, to the southward, between Little Nicobar and Kachál owes its name to it. A village, which has indifferent anchorage off it, is situated on the east side of the island. Hogs, poultry, and tropical fruits are obtainable, probably in small quantity, and the natives are reported friendly to strangers. This is the only place in the Nicobar group where the manufacture of pottery is carried on.*

Reefs are said to extend to a distance of about $1\frac{1}{2}$ miles from the north and west sides of Chaura. The flood stream in the vicinity sets to the north-east, and ebb to the south-west.

Coral bank.—To the north-west of Chaura is a coral bank, on which are depths of from $1\frac{1}{2}$ to $2\frac{3}{4}$ fathoms. This coral bank occupies a space of about $2\frac{1}{2}$ miles in length, north-east and south-west, but its exact limits have not been properly determined.

Batti Malv is an island about 150 feet in height, situated N.N.W. $\frac{1}{2}$ W. 24 miles from Chaura. It is small, of quadrangular form, the upper portion thickly wooded, and is without inhabitants. Towards the north-west part, Batti Malv becomes flattened near the coast, whereas on the west, south, and south-east sides, the rocks

* Voyage of Austrian I. F. *Novara*, 1858, Vol. 2, p. 40.

descend perpendicularly into the sea.* From a distance, this island resembles a wedge.

KAR NICOBAR, the northern island of the Nicobar group, is 8 miles north and south, by 7 miles in width. It is of moderate height, the highest ridge in the south-west part of the island being elevated about 200 feet, and thickly covered with forest. The north and north-west points of the island should not be approached too closely, foul ground extending from them. Large numbers of cocoanuts are exported from this island yearly, chiefly to Burma.

Sáwi bay.†—There is anchorage all round Kar Nicobar, but in deep water, except in Sáwi bay on the north-west side of the island, where vessels may anchor in 12 fathoms, rock and coral, with a light surface of sand, about three-quarters of a mile northward of Sáwi village. H.M.S. *Arab*, in February 1877, anchored in a depth of 7 fathoms, off the Observation spot point, where there is good landing for boats at low water. A depth of $5\frac{1}{2}$ fathoms, coral, was found by H.M.S. *Mariner* in 1887 with Observation spot point S.E. $\frac{1}{2}$ E., 6 cables; but apparently that was the least depth on the patch. The natives of Sáwi bay, where the principal village is situated, were found particularly friendly to Europeans, a great number of them speaking a little English. Supplies of pigs, fowls, fruit, and yams were obtainable by barter, old clothes being in great request.‡

Fresh water, in case of necessity, may be procured at the Areka rivulet, but not without difficulty.

Tides.—It is high water, full and change, in Sáwi bay at 10h., springs rise 5 feet. The flood stream runs to the north-east.

Kémios bay on the south side of Kar Nicobar, is where vessels occasionally anchor during the north-east monsoon. H.M.S. *Arab* anchored here in $10\frac{1}{2}$ fathoms, in February 1877, and found good landing at that season. Trading vessels find a berth in from 10 to 12 fathoms, about midway between the two villages, situated on the shore of the bay, which is a convenient position for shipping the cocoanuts.

* Voyage of Austrian I. F. *Norara*, 1858, Vol. 2, p. 43.

† See plan of Sáwi bay, scale, $m=1\cdot12$ inches, on Admiralty chart of Nicobar islands, No. 840.

‡ Remark Book of Commander F. H. D. Broughton. R.N.. H.M.S. *Arab*, 1877.

Tides in Kémios bay are regular and strong; the flood stream sets east-south-east about 3 knots at springs, the ebb in the contrary direction.

The tides round Kar Nicobar run with great velocity, making tide races, particularly to the northward of the island.

TEN DEGREE CHANNEL, about 80 miles in width, separates Kar Nicobar and Little Andaman island. It takes its name from the tenth parallel of north latitude, which may be said to pass through its centre; the Ten Degree channel is free from sunken dangers, or obstructions to navigation.

ANDAMAN ISLANDS.†

The Andaman islands occupy a space stretching from about latitude $10^{\circ} 30'$ N. to $13^{\circ} 45'$ N., and from about longitude $92^{\circ} 15'$ E. to $93^{\circ} 15'$ E. They consist of the Great and Little Andaman groups and numerous smaller islands. Between the Andaman islands and cape Negrais are two small groups, Preparis and the Cocos. The Great Andaman group is separated by narrow straits, into three large islands termed North, Middle, and South Andaman, with a fourth of smaller size, Rutland island, to the southward of them. Little Andaman island lies 30 miles southward of the Great Andaman group. The principal harbour, port Blair, is situated on the south-east side of South Andaman island. In 1789, a survey of the Andaman islands was made by Lieutenant Archibald Blair, and in the same year the Bengal government established a convict establishment at port Blair. In 1791 a change to Port Cornwallis on the east side of the North Andaman island took place, which resulted, owing to sickness, in the abandonment of the colony in 1796. In March 1858, a penal settlement at port Blair was again established by the Indian government.

The natives of the Andaman islands are of a low type, apparently oriental negroes, whose origin is involved in obscurity. Few exceed 5 feet in height, their skin is very black, and their limbs slender in proportion to their bodies; few pass the age of 40. They go naked, and live in leaf dwellings hardly deserving the name of huts. Their weapons consist of bows and arrows, and spears. An effort to

† See Admiralty chart of the Andaman islands, No. 825.

produce a grammar and dictionary of their language has been made.* They are, however, rapidly learning Hindustáni, and their own dialects are dying out. They are everywhere friendly now except at the south end of Little Andaman. At North Sentinel they are still shy, but not aggressive, and the crews of vessels wrecked on these islands may now be sure of their friendly aid provided they address them properly. With a little persuasion they will send a message to port Blair, or guide a shipwrecked party through the dense jungle to that port. It should be remembered that they are timid, and the least rough usage will result in their sudden retirement into the bush.† *See* Caution, page 280.

Fauna.—Wild pigs exist on all the islands. Turtle are also numerous. The tree lizard is common. Snipe and doves increase in numbers every year where there is cultivation. The Nicobar pigeon exists on some of the off-lying islands and the large gray pigeon lives in the thicker parts of the forests.

Snakes are not numerous, but an immense cobra, the Hamadryad, is occasionally seen. The edible bird's nest swallow builds wherever caves exist, and two or three other kinds of swallows are common.

Flora.—The flora resembles that of Burma, but the forest trees are finer, being very lofty and straight. Padauk, a heavy red wood, much prized for furniture, and marble wood of a black mottled texture are exported. Didu wood is also used for tea boxes. The bamboo grows at the north end of South Andaman, but is scarce farther south. Cocoanuts are now being rapidly introduced.

THE CLIMATE is very moist, the islands being exposed to the full force of the south-west monsoon, only four months of fair weather, January to April, can be counted on. The rainy season lasts from middle of May to middle of October, and what is called the moderate season from October to January. The average annual rainfall varies from about 100 to 155 inches. The mean temperature is about 81°. The neighbourhood of the Andaman islands is considered the birthplace of many of the violent cyclones which occasionally visit the bay of Bengal, but authentic information on this head is still wanting.

* *See* note on two maps of the Andaman islands, to illustrate a grammar and dictionary of the Andamanese languages, in *Journal of R. G. Society* for 1880, Vol. 50, p. 255.

† The remarks on Andaman islands are principally from information furnished by Commander A. Carpenter, R.N., D.S.O., in charge of Marine Survey of India, 1888, &c.

The following table exhibits the average wind and weather from 1882 to 1888.

Month.	Weather.
October	Variable wind and weather ; water spouts.
November	The first half of the month the same as October, afterwards N.E. monsoon and little rain. A cyclone is almost certain to occur in November.
December	Fresh N.E. monsoon, fairly cool.
January	Cool and pleasant, N.E. winds ; nights sometimes foggy.
February	Cool and pleasant, very clear, light airs.
March	Hot by day, cool nights, light airs, occasional haze.
April	Very hot, calm and hazy.
May	S.W. monsoon sets in about the 15th.
June	S.W. monsoon, cool, squally.
July and August	Same as June.
September	Rain every day. S.W. winds.

NOTE.—On the west side of the islands the N.E. monsoon frequently blows from North or North-west.

Mineralogy, &c.—The Andaman islands form a continuation of the line of elevation constituting the Arakan Yoma, and the geological formations are similar.

At Rangochong, a few miles south of port Blair, there is iron, copper and sulphur ore, the copper being slight. Chromite is found at Rutland island and at Chakargon. There is some serpentine at Homfray's Ghát and some jasper at Aberdeen. Limestone crops up at several places near port Blair, and might prove useful for ornamental work, being of a mottled grain. Sulphur is still being deposited at Barren island.

LITTLE ANDAMAN ISLAND, called Patang by the South Andamanese, but Eynubelong by the inhabitants, who are of the Jawarra tribe, is well-wooded, and about 600 feet high in the centre. When first clearly seen the island has a level appearance, rising gradually from both ends towards the southern centre.

Natives.—**CAUTION.**—In 1889 the natives of South Andaman island were still hostile to strangers, except at Bumila creek, at the north end of the island, which has been often visited by conciliatory expeditions from port Blair. Should a vessel be wrecked on South Andaman, it would be advisable for one or two only of the crew to land, taking with them presents of fruit, biscuit, hoop iron, &c., which they should place in a conspicuous position. The natives will then come out of their hiding places in the wood, take the presents, and probably remain to palaver. Any other method of procedure will cause the tribes to unite, and to harass the ship-wrecked by shooting

at them, from the impenetrable jungle, with bow and arrow. As soon as possible the north end of the island should be reached, whence a message for relief can be sent to port Blair.

The West Coast appears to be fringed by a coral reef, and has a sandy beach from its south-west (Sandy) point, nearly up to Jackson creek; 16 miles to the northward; it then trends north-eastward 10 miles, to the north point of the island.

Jackson creek, a small bay into which a stream runs, can be distinguished by a conspicuous square block of trees that fall abruptly to the water's edge. A reef appears to extend northward for three-quarters of a mile from the point forming the bay, and there is said to be anchorage inside the end of the reef. Just southward of Jackson creek the coast is clifty, and on the north-east side of the bay there are some remarkable clifty sandstone islands, hollowed with caves.

Bumila creek,* so called from the flies which infest it, cannot be recognised until close off the river, which then shows as a gap in the trees, the land being quite low at the north end of South Andaman. A coral reef, on which the sea generally breaks, stretches nearly across Bumila entrance; the channel is round the west end of this reef, and has 7 to 8 feet at low water. There is anchorage in 8 fathoms, dead coral, about 4 cables northward of the entrance, with the centre of the river bearing S.S.E. This anchorage should be approached from the north-westward, in which direction the water is clear; north-eastward of Bumila creek towards the Brothers there are irregular shallow soundings.

Position—The mouth of the small stream, which runs into Bulima creek on the eastern shore near the entrance reef, is in lat. $10^{\circ} 53' 32''$ N., long. $92^{\circ} 29' 55''$ E. (approximate).

Tides.—The streams set E. by N. and S.W. at the anchorage off Bumila creek, and there is sometimes a strong ebb stream out of the creek.

Dalrymple bank, oval shaped, and 7 miles in diameter within the 20 fathoms line, lies with its centre about 9 miles westward of Sandy point, Little Andaman. The general depth on this bank is 13 to 18 fathoms, broken dead coral, but near the centre there are ridges of rock with as little as $5\frac{1}{2}$ fathoms on them. Possibly less water may exist, and vessels should not cross the bank, (especially in the south-west monsoon), where dangerous rollers may get up.

* See Admiralty Chart :—Port Blair to Little Andaman island, &c., No. 1398.

Depths of over 30 fathoms will be obtained 2 to 3 miles westward of the shoal centre.

South Sentinel, south 32 miles from North Sentinel, is a small uninhabited level-topped island with a low point on its south side. It is 144 feet high and has much the same appearance on any bearing. It is separated from Little Andaman by deep water, and stands on a bank which trends 7 miles N.W. of it, with depths of 12 to 30 fathoms, dead coral. There are no dangers round it much outside the fringing reef, and no landing on it except on the north side in fine weather. The west side is the most shelving, and anchorage can be had, in 14 fathoms, 8 cables W. by N. from the centre of the island, with the extremes of the island subtending an angle of not more than 35°.

Turtle are plentiful here, and there are great numbers of the robber crab.

The Brothers* are two small flat-topped islands, lying 6 and 10 miles N.E. by E. of the north point of Little Andaman. They are each about 90 feet high, wooded to the water's edge, with a fresh water lagoon in the middle of each. A small reef surrounds North Brother, and between the two islands is a detached patch known as Leeboard ledge. The passage between the Brothers is not recommended.

A dangerous reef extends N.W. by N. from South Brother and generally breaks near the end about $1\frac{1}{2}$ miles from the island, but foul ground extends 5 miles N.W. by W. from the island, or 3 miles west of the breaking reef. At 7 miles distant there is deep water. Between South Brother and Little Andaman there is a channel $5\frac{1}{4}$ miles wide, but a detached reef, known as Ariel ledge, occupies the centre of the channel W.S.W. of South Brother, and thus narrows the channel considerably; the soundings are also so irregular that the passage is not recommended.

A reef also projects S.E. by E. from South Brother.

Great numbers of gray pigeon breed on South Brother.

DUNCAN PASSAGE, 9 miles in width, is the main channel between the Little and South Andaman islands, and named after the captain of the *Ganges*, who in 1760 first successfully navigated it on a voyage to Manila. The depths in this channel are from 12 to 20 fathoms sand, so that a vessel may anchor in case of being overtaken by darkness.

* See Admiralty Chart :—Port Blair to Little Andaman island, &c., No. 1398.

DIRECTIONS.—In light breezes and fine weather the tidal streams set through the Duncan passage with fair regularity, but at times currents prevail which are generally governed by the wind. In the north-east monsoon, on both sides of the Andaman islands, the current sets mostly to the south-west or southward. A sailing vessel in making the Duncan passage, should therefore endeavour to keep a little to the northward in this season, and to the southward during the south-west monsoon, according to the prevailing wind, so as to preserve a leading wind in passing through the channel.

To avoid the foul ground north-westward of South Brother, the North Brother should not be brought to bear eastward of E. by S., while the east extreme of Little Andaman island is southward of S.S.E.

The Sisters, two small islands close together on the north side of Duncan passage, stand on a bank of 5 to 12 fathoms, coral, and the 100-fathoms line passes within $1\frac{1}{4}$ miles east of them. A rocky spit extends 7 cables N.W. from the ledge connecting the two islands. The Northern island is 306 feet high.

Passage island, north-westward of the Sisters, is 351 feet high, and about three-quarters of a mile in extent. Its north end is high and rounded, and is so seen when first sighted, but the south end is low.

A detached rock 6 feet high lies 3 cables N. by W., and a bank, having $6\frac{3}{4}$ fathoms least water, 2 miles W.S.W., both from the north end of the island. The latter consists of a narrow rocky ridge fringed with sand. At spring tides there are overfalls. The channel between Passage island and the Cinque islands is safe, but there are tide rips at spring tides; it is 3 miles wide, and has an average depth of 28 fathoms.

Cinque islands, consisting of two hilly narrow islands, almost joined by a rocky ledge awash at high water, are moderately high, and lie in a N.N.E. and S.S.W. direction 3 miles off the south-east coast of Rutland island, with Manners strait between. The trees on both islands are most remarkably contorted by the south-west monsoon.

North Cinque island has two summits, forming a saddle, about 570 feet high, and near its south end is a small conical bare hill, from which a low promontory projects westward, forming a bay. Depths of 9 to 10 fathoms, dead coral and sand, will be found with the west point of the island bearing N. by W.

South Cinque island is 545 feet high and larger than North Cinque, with also a conical knoll at its south end. Both the islands are fairly steep-to, and the only anchorage is west of the sunken ledge joining them.

Manners strait, between Cinque islands and Rutland island, is 3 miles in breadth. There is usually a tide rip across it at any time. This passage is the one preferred by steamers running to or from port Blair, and with a leading wind would be preferable to Duncan passage for sailing ships.

RUTLAND ISLAND is close southward of South Andaman. The northern half of this island is high, and culminates in a peak, mount Foord, 1,422 feet high. The southern half is of moderate height, 744 feet, and is joined to the northern by a low neck of land formed by two bays.

The eastern of these, Portman bay, is a deep indentation, having a mangrove swamp and shallow water at its head and irregular deep soundings in the centre. A considerable swell sets into it in the north-east monsoon. The western, Wood-Mason bay, has its northern side filled up with reef, but the south part of it appears to be clear of shoals. The whole island is densely wooded, which is the case with all the Andaman group. Its shores are difficult of access, and the natives are not so friendly as on South Andaman.

Off the south point of the island a bank of boulders extends nearly a mile seaward and there are some irregular patches beyond. It will be well therefore not to approach the south coast within $1\frac{1}{2}$ miles except at the narrows of Manners strait where the coast is steep-to. A large bank of dead coral, about 4 miles square, having not less than $6\frac{3}{4}$ fathoms of water over it, lies with its centre $6\frac{1}{2}$ miles S.W. of the south-west point of Rutland island, and is quite safe to pass over in ordinary weather.

Investigator rock, with a depth of .3 fathoms on it, and nearly always marked by a tide rip, lies with the south extreme of Rutland island N.N.E. $\frac{3}{4}$ E. 9 cables, and the south-west extreme of the island N.N.W. $\frac{3}{4}$ W.; depths of under 10 fathoms extend about 3 cables south of the rock, and 2 cables east and west. A patch of $4\frac{1}{2}$ fathoms lies on the north-east edge of this shoal ground.

The Twins are two level topped wooded islets, 150 feet high, lying close off the south-west side of Rutland island. They stand on a reef, and a dangerous ledge projects $1\frac{1}{2}$ miles to the S.W. from the West Twin. About half way out on the ledge Turtle rock is visible, except at high water, when it is covered.

LABYRINTH ISLANDS consist of fourteen islands, all rocky and fringed with coral reefs; Tarmugli, the largest, is 3 miles long. On their seaward face the coral reefs project nearly a mile out, and large blocks are broken off by the sea during the south-west monsoon and are thrown on to the reef, giving an appearance as of rocky boulders. The channels between the islands are nearly full of coral heads, but the passage between the two south-eastern islands, Malay tapu and Jolly Boys island, is clear in comparison, and leads to the western end of Macpherson strait. The islands and shoals adjoining the track into this strait will now be described.

Boat island, $1\frac{1}{2}$ miles long, half a mile broad, and 200 feet high, is the south-western of the group, and has a coral reef projecting from it one mile to the southward. Natives resort to this island for fishing.

Jolly Boys island, lying close to Rutland island, has coral reefs extending 6 cables S.W. of it and 2 cables W. and N.W. of it. This reef is generally visible.

Malay tapu, one mile N.N.W. of Jolly Boys, has a rounded summit at its north end. A rocky ledge extends off its south point.

Hobday island, the next to N.E. of Malay tapu and almost touching it, has a rocky ledge extending off it half a mile towards the north point of Jolly Boys, and this continues under water, forming a ridge of $4\frac{1}{2}$ fathoms, and crops to the surface again in Beauchamp patch.

Beauchamp patch, a small coral head nearly awash at low water springs, but not often visible by its discoloration, is $3\frac{1}{2}$ cables N. by E. $\frac{1}{2}$ E. from the north point of Jolly Boys. It has been marked by a perch.

Pluto island, small and rounded, lies by itself east of Hobday island, and is useful as a leading mark.

Brooker rock, a dangerous pinnacle of rock with only 5 feet over it at low water, lies $8\frac{1}{2}$ cables S.W. by S. of the south point of Malay tapu. There is a depth of 5 fathoms close to this rock.

Peck shoals are a cluster of coral heads lying to the north of the channel.

MACPHERSON STRAIT.—The western entrance is narrow and much hampered by coral reefs. Both shores of the strait are fringed with coral reef, on the edges of which pieces show above water. In the strait proper there is only one danger, which is

about half-way through, and consists of a ledge of rocks which projects $4\frac{1}{2}$ cables E.N.E. from the Rutland island shore into the channel. The ledge can always be made out, and a vessel will clear it by keeping to the northward until the western entrance is shut in by the northern shore. The eastern entrance point, Chiriya tapu, is a conspicuously bare promontory, under which are some caves in which edible bird's nests are found. A rock which never quite covers lies half a mile to westward of this point, and has deep water to westward of it. Vessels should not pass between the rock and the point.

Directions from Westward.—In following these directions the least water passed over will be about $4\frac{1}{2}$ fathoms. Bring Jolly Boys island to bear N.E. $\frac{1}{2}$ E. when it is at least 5 miles off, and steer towards it on that bearing until the whole of Pluto island, (which is small and lies well back in the bay northward of Jolly Boys island,) is open two-thirds of its length eastward of Malay tapu. Then steer for Pluto island, about N.E. by N., taking care not to bring it nearer to Malay tapu, to pass about $2\frac{1}{2}$ cables westward of Jolly Boys reef, (generally visible), and the same distance eastward of Brooker rock. When Jolly Boys island summit is abeam alter course to N.E. until the south extreme of Boat island is nearly touching the south extreme of Malay tapu, W. $\frac{5}{8}$ S., this mark on astern leads between Peck shoal and Beauchamp patch, and up to the entrance of the strait, through which a vessel should keep in mid-channel.

Tides.—Brooker rock and Beauchamp patch are hidden by discolouration of the water at springs, but the tide whirls are not strong there, and it is only in the narrows north of the islet which marks the western entrance point of the strait that the stream is rapid. The flood stream sets to the eastward, and runs until high water; the ebb to the westward, and runs until low water. The ebb stream is very weak north-eastward of Rutland island.

Anchorage.—There is anchorage in 6 to 10 fathoms in the northern part of the eastern half of the straits with Chiriya tapu point bearing S.E. by E. distant $1\frac{1}{2}$ miles.

North Sentinel island is about 15 miles west of Labyrinth islands, the channel between being clear and carrying about 45 fathoms, the bottom being ooze. This island is 400 feet high and has a level ridge, which however slopes to a very low north-west point. The shape of the island is nearly square and its sides are each

4 miles in length. A coral reef nearly surrounds the island at a distance of half to three-quarters of a mile from the coast, and the lagoons between the reef and the shore have depths of 3 to 8 feet. There are several entrances through the reefs fit for boats and there is anchorage outside all of them for a vessel in the fine season. Four islets stand on the reef, the largest being at the south-east corner of North Sentinel.

The best landing place and anchorage is however on the east side of the island, where 10 fathoms may be obtained half a mile off shore with the north-east point bearing N.W. by N. South of this coast there are sunken dangers.

The island is seldom visited by Europeans. The natives are very shy.

There are no dangers outside the reefs, and the 100-fathom line passes 3 miles west of the island.

The isolated dangers and islands eastward of the Andamans will now be described.

INVISIBLE BANK, about 30 miles in length north and south, by 13 miles in width, lies about 50 miles eastward of Duncan passage. The soundings on this bank vary generally from 17 to 50 fathoms, but its limits have not been properly determined. The water over it does not appear discoloured.

Flat rock, awash at high water, and about 30 yards in diameter, with foul ground extending from it about a third of a cable to the southward, is situated a little south of the centre of Invisible bank, in approximately lat. $11^{\circ} 8' N.$, long. $93^{\circ} 31' E.$ The soundings about 2 miles from the rock are 12 to 15 fathoms.

Caution.—Vessels in the vicinity of Invisible bank and Flat rock should keep the lead going, the position given above of Flat rock being uncertain.

Barren island, in lat. $12^{\circ} 15' N.$, long. $93^{\circ} 50' E.$ is 1,158 feet high, and 2 miles in diameter, with the outer slope of the crater near the centre of the island, covered with foliage. On the western side the crater wall is broken down and permits a view of the interior. Here is the landing place, in a nook formed by an outflow of lava through the gap in the crater wall. A hot spring trickles through the beach at the landing place and its temperature in 1886 was 110° Fahrenheit. The volcano was last seen to be active in 1803 but has ejected lava since that date. Since 1857 only a thin column

of steam has issued from the summit. There are no dangers round the island at half a mile distant and it slopes regularly to the floor of the ocean, here 1,100 fathoms deep. There is anchorage in 14 fathoms $2\frac{1}{2}$ cables off a beach on the south-west side of the island. There is no water on the island in the dry season except the hot spring, the water of which is just palatable when cooled. The island is infested by great numbers of rats.

Narkondam island, in lat. $13^{\circ} 26' N.$, long. $94^{\circ} 15' E.$ is an extinct volcano, 2,330 feet high, and a truncated cone in shape. Several small rocks above water lie close round its sides within 80 yards of the coast, but there appear to be no dangers outside of these. At half a mile from the coast the depths average 120 fathoms, but on the N.N.W. side of the island there is an islet or large rock which forms some shelter for landing and there is said to be anchorage one cable West of it.*

The Andamanese never visit Narkondam now, but Burmese fishing boats have been known to be driven there and to Barren island.

SOUTH ANDAMAN ISLAND, separated from Middle Andaman by the narrow and intricate Andaman strait, is 44 miles in length, north and south, by from 16 to $2\frac{1}{2}$ miles in width. On its eastern side are situated ports Blair and Meadows, and on its western side, ports Mouat and Campbell. Of the interior but little is known. The native name for this island is Elakabea (Da) and the name of the tribe which inhabit it is Bojigngiji (Da).†

PORT BLAIR‡ at first called port Cornwallis, then port Chatham, and eventually by its present title, after the Lieut. Blair who first surveyed and colonised it in 1789,§ is an excellent harbour and the head-quarters of the representative of the Indian Government amongst the Andaman and Nicobar islands.

No vessels are allowed to visit port Blair for commercial purposes except under Government contracts, and vessels wishing to visit and trade at the Nicobars are obliged to call first at port Blair and obtain a permit.

* The name Narkondam appears to be derived from Naraka Kundam, signifying "a pit of hell," and was probably meant for Barren island, but the names have somehow been confused.

† These names are in the Bojigngiji language, the only one with which we are at present familiar.—(Note on map of Andaman islands by E. H. Man, M.R.A.S. p. 254 of R.G.S. Journal for 1880.)

‡ See Admiralty plan of port Blair, No. 514, scale, $m = 5$ inches.

§ See *Memoirs of Hydrography*, 1st Part, page 18.

A detachment of infantry and a large police force guard the convicts, of whom there are about 12,000, the entire population numbering 17,371 in 1891. Tea, coffee, cocoa, paddy, Indian corn and vegetables are cultivated. The edible bird's nests are now a Government monopoly and yield a considerable revenue.

The port is a narrow inlet running in a west and then a southerly and south-west direction for about 6 miles, with numerous arms branching from it, and towards its head becomes too shallow for vessels of large draught.

ROSS ISLAND, on the south side of the main entrance to port Blair, is about three-quarters of a mile in length north-east and south-west, by 3 cables in width, and about 150 feet high. At the north end are some handsome castellated barracks, near to which, on the highest part of the island, is Government house, approached by a road terminating in a wooden pier on the western side.

LIGHTS.—From the yard-arm of the flagstaff at the north end of Ross island a *fixed white* light is shown at an elevation of 159 feet above high water, and visible 8 miles in clear weather. A *fixed red* light is shown from the end of the wooden pier projecting from the western point of Ross island.

Buoys.—A reef projects 3 cables westward of Ross island. Two red buoys, one at the north, and the other at the west extreme of the reef, each moored in 7 fathoms, mark its edge.

Sesostris shoal, a coral patch lying half a mile off-shore, and one mile S. by E. $\frac{1}{4}$ E. from the south end of Ross island, is the chief danger near the southern entrance to port Blair. A red buoy is moored in 8 fathoms on the eastern edge of the shoal.

The North entrance between North point and Ross island is $1\frac{1}{4}$ miles in width with depths of 23 to 30 fathoms. Immediately west of North point is North bay, an arm of the harbour which is not used, and which has a beautiful coral reef fringing its shores. One mile westward of North bay is Semiramis or Hope Town cove.

Mount Harriet, 1,193 feet high, is situated about $1\frac{1}{4}$ miles inland north of this cove and is sometimes used as a sanatorium, a good road leading to it from the pier. On the west side of Command point, which is the west arm of Semiramis cove, are the coal sheds and piers.

Half a mile west of Command point is Bamboo Flat bay, at the head of which is a foundry and smithy, and a boat building shed.

Brigade creek, a mangrove course, debouches immediately west of Bamboo Flat bay and causes a projecting shoal of mud and sand that stretches nearly half of the distance across to Chatham island.

Chatham island, $2\frac{1}{4}$ miles westward of Ross island, is now only used for sawmills. It is steep-to on its northern side but its south side nearly joins Blair reef, a rocky ledge which extends from Aberdeen peninsula. The east extreme of Blair reef bears E.S.E., 6 cables from Chatham island and partly covers the entrance of Phoenix bay, a small inlet on the Aberdeen side which is used for repairing boats. A buoy with a staff and cage is placed at the northern extreme of the reef.

Viper island, the present site of the convict jail, is covered with buildings, one of which is a blanket manufactory. Westward of this island the harbour is quite shallow.

Navy bay, eastward of Viper island, has depths varying from 18 to 23 feet, but not much space with the latter depth. At its head are sawmills, and a rifle range; with tea gardens on the land to the southward.

DIRECTIONS.—To pass westward of Sesostri's shoal, the white-washed barracks on Command point should be kept just open of Atalanta point, N.W. $\frac{1}{3}$ W.; and the same mark kept on leads in mid-channel between Ross island and South point; after passing which course may be altered for the anchorage under Ross island.

Vessels entering northward of Ross island should give it a berth of about half a mile, and in making for the anchorage westward of Ross island should leave the buoys marking the reef in that locality on the port hand.

The mark for leading northward of Blair reef is to keep Shore point, on the northern side of the harbour, just open of the north-east extreme of Chatham island, W. by N. $\frac{3}{4}$ N.; and that for leading southward of Ranger flat, stretching off Shore point, is Perseverance point, on the northern side of the harbour, in line with the north extreme of Chatham island, E. $\frac{3}{4}$ N.

Anchorage.—The anchorage always used is that westward of Ross island, in about 8 to 9 fathoms, sand, one to 2 cables south-westward of the jetty.* But the best anchorage in the harbour is

* The Indian Government steam-vessel *Enterprise*, at the anchorage under Ross island, dragged her anchors, and was wrecked on South point, the majority of the crew being drowned, in the cyclone that passed over port Blair on the night of 1st November 1891.

about half a mile W.S.W. of Chatham island, in 7 to 8 fathoms, mud, with perfect shelter.

Tides.—It is high water, full and change, at 9h. 55m. Mean springs rise 6 feet ; mean neaps rise 5 feet.

Observation spot is at the port office jetty on the west side of Ross island, its position being in lat. $11^{\circ} 40' 34''$ N., long $92^{\circ} 44' 56''$ E. (approximate).

Communication.—Mails are brought from Calcutta every four weeks by the steamers of the Asiatic Steam Navigation Company, which vessels also bring an intermediate mail from Rangoon.

Coal.—A sufficient supply is kept for the ordinary requirements of vessels-of-war. The coaling place is on the west side of Command point, on the north side of the harbour. Here are coal-sheds and piers, alongside which large vessels can coal. Two buoys are provided for the offshore hawsers, as vessels must lie about 10 feet from the pier ends (at which distance there is a depth of 30 feet) to keep their bilges off the edge of the fringing reef.

Trade—Shipping.—The principal export is timber ; valued in 1890 at Rs. 117,862. The imports are goods and stores for the Settlement, and Marine and Commissariat Department ; valued in 1890 at Rs. 758,329. In 1890 the port was visited by 61 vessels of 61,783 aggregate tons.

Repairs.—Small repairs to ironwork of ships can be effected at the foundry at the head of Bamboo Flat bay, north-westward of Command point.

Supplies.—Excellent water is brought from Hopetown, about 2 miles from Ross island ; the water is brought alongside from there in tanks. At Ross island, water is led down the hill side in pipes to the pier, and can be turned on into a boat alongside, but it is not so good in quality as the Hopetown water. Fresh provisions can be procured from the commissariat.

Quarantine.—The port is healthy now that the forest in its immediate vicinity has been cleared away. Two barracks are reserved for quarantine accommodation at Perseverance point, but up to 1889 they had not been used for that purpose.

Hospital.—The general hospital is on Ross island ; all free persons are admitted at fixed fees.

Climate.—The following table is from observations taken at port Blair, at an elevation of 61 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Mean.	Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	79	86	75	11	18	77	3·4	0·9	2	29·90	·10
February - -	80	88	74	14	20	78	2·8	1·3	2	—89	·11
March - -	82	91	76	15	21	78	2·9	0·4	1	—87	·11
April - -	83	92	78	14	20	78	4·1	2·4	5	—80	·11
May - -	81	89	78	11	19	84	5·0	15·9	20	—75	·09
June - -	81	86	78	8	16	86	7·0	17·9	25	—73	·08
July - -	80	86	77	9	15	86	7·1	16·5	26	—74	·07
August - -	80	85	77	8	15	87	6·9	15·2	25	—75	0·8
September - -	79	85	76	9	15	88	6·9	19·6	25	—78	·09
October - -	80	87	77	10	15	87	5·8	11·8	22	—81	·10
November - -	80	87	77	10	16	84	5·0	9·5	15	—84	·10
December - -	79	86	76	10	18	81	4·5	5·3	9	—88	·10

THE COAST of South Andaman island, from port Blair southward to the entrance of Macpherson strait, a distance of 13 miles, is bold and free from danger. The 100-fathom line, here approaches the coast, to within a distance of 2 miles.

North of port Blair the coast is bold and straight, and trends in about a N. by E. direction, for about 14 miles to Shoal bay. The land above this part rises in a broken ridge, and is 1,193 feet high near port Blair, to which it descends rapidly, and thus pointedly indicates the locality of the port.

Shoal bay, extends in a W. by S. direction for 3 miles and then turns southward for 7 miles, being a narrow inlet between the hills. At its entrance it has a depth of $4\frac{1}{2}$ fathoms, rapidly shoaling however to depths of one to 3 fathoms. It is fringed with mangroves, but the hills are clothed with fine forest trees, which are here cut for export. Off the north end of Shoal bay is Kyd island, a lofty rounded hill.

Oyster bay, 2 miles north of Shoal bay is narrow, extending in a westerly direction for about 2 miles, the south shore being

formed by the north coast of Kyd island. In it are depths of from 5 to 10 fathoms.

PORT MEADOWS* 2 miles northward of Oyster bay, extends in a westerly direction for about 2 miles, and though narrowed in the entrance by Entry island to a width of $1\frac{1}{2}$ cables, opens out inside, into two considerable sheets of water, in the southern of which there is good anchorage in 9 fathoms. On the north side of the passage leading in, are two patches of 4 and $4\frac{1}{2}$ fathoms, for the position of which, as well as for general guidance, the reader is referred to the chart. North of Entry island the passage appears blocked by shoal patches. The shores of port Meadows have coral reefs extending off them, and the surrounding land is generally low, with extensive tracts of mangrove jungle, intersected by creeks and forming several small islands.

ANDAMAN STRAIT.—Eastern entrance, separating South Andaman from Middle Andaman and Baratán island, is narrow and intricate, its eastern end being blocked by a bar, the depth over which is from 9 to 10 feet at low water. It is a natural channel amongst the undulations of the hills, which are lower at this part of the Andaman range than elsewhere. The channel is narrowed at one or two points to about 80 yards, its general breadth being from 2 to 3 cables. A depth of 10 to 14 fathoms is generally found throughout the narrow part of the strait. The bottom throughout is mud and sand, and one or two ridges of shallow water cross it, but nothing less than 3 fathoms at low water. About half way through, where the trend of the strait changes from north and south to east and west, there is an island, Orol kaicha, which may be passed on either side, but the channel round the north side of the island has more moderate curves. Near Spike island, at the west end of the strait, the bottom becomes foul; attention must therefore be paid to the directions mentioned further on under "Spike island" (page 304). H.M.I.M.S. *Investigator*, drawing 13 feet, passed through this strait three times in the year 1888 whilst surveying the islands. The stream through the strait is never strong.†

Directions.—From the eastward the entrance to the strait is not easy to distinguish. It is a low mangrove bay 3 miles north of Entry island (port Meadows). Off either extreme of the bay are ledges of rock, and the bay should be approached from the eastward. The

* See Admiralty plan :—Port Meadows, No. 839 ; scale, $m = 6\cdot25$ inches.

† See Admiralty plan of Andaman strait, No. 838 ; scale, $m = 1\cdot55$ inches.

channel in on this side lies towards the north shore, and the inner north entrance point should be brought to bear W. by S., steered for on that bearing, and rounded at a distance of one cable.

Tides.—It is high water, full and change, near the south part of Andaman strait at 10h. 24m., and near the north part at 9h. 42m. Springs rise 8 feet. The flood stream sets to the southward through the strait, but is weak, not exceeding $1\frac{1}{2}$ knots.

For description of the western coast of South Andaman island *see* page 306; and for directions for western entrance to Andaman strait, *see* page 305.

THE ARCHIPELAGO* which lies 7 to 18 miles off the east coasts of Middle and South Andamans, and is separated from them by Diligent strait, extends from lat. $11^{\circ} 46'$ N. to lat. $12^{\circ} 15'$ N., and consists of 10 islands. They have not been sufficiently examined to show what harbours they contain.

Sir Hugh Rose island, the most southern, is E. by N. $\frac{3}{4}$ N., 20 miles from port Blair. It is 218 feet high, with large trees covering its surface from high water mark to the summit, a feature common to all the Andaman islands.

The eastern extreme is formed of conspicuous yellow cliffs, about 80 feet in height. A reef dries about one cable from the eastern and western sides of the island, and rocky ground, on which the sea breaks, extends for a cable outside the edge of the reef. Sunken rocky ground stretches southward for 2 cables from the south-west point, sloping gradually to a depth of 10 fathoms at one mile from the point. Vessels should not pass between this island and Neill island, and in approaching port Blair from the northward should pass about 2 miles southward of Sir Hugh Rose island south point.

Neill island lies about 2 miles north-westward of Sir Hugh Rose island. Its eastern portion is 370 feet high, with white cliffs rising abruptly from the sea. A rock, about 20 feet high, lies one cable off the north-east point. The southern coast is low and fronted with mangroves. A reef, on which the sea breaks heavily, extends 3 cables from the southern point; and a patch of 3 fathoms, on uneven ground, lies a mile off the south-western coast. The south-west point is about 50 feet high. The passage between Neill and Havelock islands is said to be clear of danger with deep water near Havelock island.

* *See* Admiralty chart :—Long island to port Blair, No. 1,419.

Havelock island is of an oblong shape, and about 11 miles in length. The south point is formed of high white cliffs; one, which is almost insulated, having from some positions the appearance of a sail. On the south-west side are two small bays, from the southern of which tidal creeks run inland for some distance. The north-east part of Havelock island should not be approached from the eastward nearer than 5 miles, to avoid a coral reef apparently connected with the island. The passage between Havelock and Sir William Peel islands has been used by a local steamer, but the channel is not recommended.

Sir William Peel island is separated by narrow straits from the surrounding islands. It appears to be low and thickly fringed with mangroves.

Nicholson island, narrow and hilly, with its northern summit 379 feet high, is separated from Sir William Peel island by a channel a quarter of a mile in width. The northern and southern extremities are sharp, white, conspicuous points. A reef extends southward about three-quarters of a mile from the southern point.

Wilson island is separated by narrow channels, which have not yet been examined, from Nicholson island on the south, and John Lawrence island on the east. The central peak of Wilson island, hitherto known as Round hill, is 758 feet high. Foul ground, thickly strewn with coral heads, occupies the bay on the north side of the island, and continues along John Lawrence island to its northern point.

Two Fathoms rock lies N. by E. $\frac{3}{4}$ E., $1\frac{1}{4}$ miles from the north-west point of Wilson island.

John Lawrence island is about 500 feet high. Its north-western coast is very foul, and rocky heads extend off its northern point for half a mile. Pilot reef is reported to exist about $2\frac{1}{4}$ miles south-eastward of the south point of John Lawrence island.

Minerva ledge is an isolated rocky patch, one mile in length, within the 10-fathoms line, lying 4 miles inside the 100-fathoms line, and about 6 miles eastward of the south end of John Lawrence island. A depth of 12 feet has been reported on this ledge, situated with the east extreme of Inglis island, N.N.W. about 5 miles.

Kwangtung strait, separating John Lawrence island from Henry Lawrence island, has not been examined, but is believed to be navigable by keeping in mid-channel.

Henry Lawrence island.—The west coast of this island, from Kwangtung strait to the north point, is clear, and consists of a ridge rising to a height of 567 feet; with a narrow drying reef, on which are scattered mangroves, fringing the coast.* Inglis island is eastward of Henry Lawrence island. Charka Juru, the strait between Henry Lawrence island and Outram island, has not been examined, but it is believed to have a clear passage.

Outram island.—The western coast is similar in feature to that part of Henry Lawrence island described above, and attains an elevation of 298 feet just over the south-west point. The reef juts out from the north-west point, and has low rocks on it; shallow water extends half a mile north-eastward of this point, and nearly the same distance northward of the north-east point of the island. A deep bay, with good shelter from southerly winds, occupies the whole northern side of Outram island. In entering this bay keep along its eastern shore, a quarter of a mile off, and haul out towards the centre when Middle Button begins to shut in behind the north-west point, anchoring directly in 10 fathoms.

North Button island, three-quarters of a mile long, occupies a conspicuous position at the northern entrance to Diligent strait. This island is 207 feet high, and terminates in low irregular cliffs at the eastern point, while on the western side it falls abruptly to a spit of sand covered with trees. Shoal water extends from both points in east and west directions, and vessels should give the island a berth of a mile on those bearings.

There are no dangers on the north side of the island, but the bottom is rocky. On the south side there is good anchorage close to the reef, which here fringes the coast to a distance of half a cable.

Position.—On the summit of the cliff on the south side of North Button island is a station of the Great Trigonometrical Survey of India. The position is marked by a stone with a circle and dot, and is in lat. $12^{\circ} 18' 56''$ N., long. $93^{\circ} 3' 21''$ E. (approximate).

Middle Button island is 3 miles south-westward of North Button, and 164 feet high; the north end is clifty; the south point terminates in a short sand spit, off which lie a few low rocks. A tail of shoal-water extends $1\frac{1}{2}$ miles south-westward from the island. The whole of North Button open eastward of Middle Button, N.E. by N., leads eastward of this shoal ground. Good

* Janes patch, formerly marked on the charts in lat. $12^{\circ} 9'$ N., long. $93^{\circ} 12'$ E., does not exist.—Commander Carpenter, R.N., 1889.

anchorage will be found southward of Middle Button island, taking care to avoid the shoals near. From the northern end of the island shoals stretch $1\frac{1}{2}$ miles towards North Button.

South Button island, 118 feet high, is a peculiar collection of large rocks, steep-to all round. A coral patch, with $1\frac{3}{4}$ fathoms on it, lies one mile south-eastward from South Button; and a rocky head, with $5\frac{1}{2}$ fathoms on it, lies one mile east of that island. South Button forms a useful leading mark for navigating Diligent strait.

BARATAN ISLAND is the southern detached portion of Middle Andaman. The coast, from the eastern entrance of Andaman or Middle strait, trends in a north-easterly direction for 13 miles, and is deeply indented with bays and inlets. The land is hilly, and the coast line is fronted by mangroves, growing on reef.

Anchorage may be found in these bays, except during the south-west monsoon, when there is probably a heavy ground swell.

From the eastern point of Baratan island, a chain of islands, reefs and rocks extends for 15 miles in a northerly direction. The islands are separated from each other by narrow channels; between Guitar and North Passage islands is the entrance to Homfray strait, which divides Middle Andaman and enters the sea westward at Spike island. Lieutenant Blair remarks that the bays and inlets formed by Colebrook, North Passage, Guitar and Long islands are too confined and intricate to be of use, but shelter might possibly be found by a vessel in distress. About 2 miles eastward of Guitar and Long islands there are said to be several dangerous patches of coral; and a ridge with shoal and irregular soundings on it connects Guitar island with North Passage island. The whole eastern side of North Passage island is very foul, coral heads and patches extending one to 2 miles off the coast. This uneven ground joins to that eastward of Strait island.

Rong at inlet in lat. $12^{\circ} 29' N.$ is very remarkable, having a bold bluff point on either side; the entrance is narrow, and there is not sufficient depth for anchorage inside. The entrance points have reefs off them, and there is foul ground a mile eastward of the inlet. The coast trends northward from Rong at, and is high.

Strait island, 380 feet high, is the southern of the islands mentioned above. Its southern end terminates in a narrow ridge, with a head of $2\frac{3}{4}$ fathoms, 3 cables south-westward of the extreme point. Foul ground extends off the eastern and northern sides of Strait island for $2\frac{3}{4}$ miles, and vessels of deep draught should not approach within 3 miles of that island when it bears south-westward.

Anchorage in 10 fathoms may be obtained about one-third of a mile north-westward of Strait island south point.

DILIGENT STRAIT is the main channel among the islands south-eastward of Middle Andaman island; the least water to be passed over in going through it is $6\frac{1}{2}$ to 7 fathoms, south-eastward of Strait island.

DIRECTIONS.—In approaching from the southward, steer for Strait island until South Button island touches the north extreme of Outram island, N.E. $\frac{3}{4}$ E., then steer through the narrow part of the strait with that leading mark on, until the eastern extreme of Middle Button bears N. by E. $\frac{3}{4}$ E., when alter course to pass westward of South Button and midway between Middle Button and Outram island.

In approaching from the northward, pass a quarter of a mile westward of South Button, and then bring the leading mark given above on astern, and keep it on until the north point of Nicholson island is seen open of the north-west point of Wilson island, S. $\frac{3}{4}$ W., when course may be altered to pass about a mile westward of Wilson island north-west point.

The last leading mark given passes a quarter of a mile westward of Two Fathoms rock, situated one mile northward of Wilson island.

Tides.—It is high water, full and change, at Strait island at 9 h. 58 m.; springs rise $7\frac{1}{2}$ feet, neaps $5\frac{1}{2}$ feet, and neaps range $3\frac{1}{2}$ feet. High water is at about the same time as at port Blair, low water about half an hour later. In Diligent strait the tidal streams are weak, but probably with strong southerly winds, a considerable northerly set will be found in the narrows.

Sound island, its south end in lat. $12^{\circ} 56' N.$, near the coast and off the north-east point of Middle Andaman island, is of irregular quadrilateral shape, and about 5 miles in length, north-east and south-west, by $2\frac{1}{2}$ miles in width. It forms the eastern side of a land-locked bay, accessible at all seasons to vessels of every class. The island consists of ridges of high land traversing it in all directions, and prolonged in spurs to the points of the bays indenting its margin. It is fringed with belts of mangrove and surrounded by coral reefs, with occasional sandy beaches near the shore. There is good anchorage between the north side of Sound island and North Andaman, in 10 fathoms, clay.

STEWART SOUND is situated south-westward of Sound island. Its northern and eastern sides are skirted by coral banks, but

in the rest of its extent it has good anchorage for large vessels. The ridge of hilly ground surrounding Stewart sound is about 120 feet in height.

The western or upper portion of Stewart sound appears to connect by water with Austin strait, which divides the North from the Middle Andaman island.

Tides.—It is high water, full and change, in Stewart sound at 9h. 45m. Springs rise $8\frac{1}{2}$ feet.

The east coast of North Andaman island, northward of Sound island, trends about N. by E., is hilly to the water's edge, and affords no good landing place. In one or two places a near approach reveals some tolerably deep caves. The soundings off it are said to be regular to the 100-fathoms line, which is 5 miles off shore.

Craggy island, 16 miles northward of Sound island, and 4 miles southward of the entrance to port Cornwallis, is small and connected to the shore by a reef, on the south side of which is anchorage in from 4 to 10 fathoms. The coast near Craggy island is apparently well inhabited.

Saddle hill, about 2,400 feet high, and the most elevated land of the Andaman islands, is situated about 6 miles south-westward of Craggy island. This hill, which is covered with vegetation, appears as two peaks when viewed from the east or westward, giving the hill the appearance of a saddle, hence its name.

PORT CORNWALLIS.*—The entrance of which is $4\frac{1}{2}$ miles northward of Craggy island, or in about latitude $13^{\circ} 17'$ N. extends about 6 miles in a north-west direction, and has an average breadth of $2\frac{1}{2}$ miles. The convict settlement which was established here from 1791 to 1796, was situated on Chatham island, which is 4 miles up the harbour. The site on account of its unhealthiness was abandoned. Dense belts of mangrove line the shores, otherwise it is a fine harbour, affords an abundant supply of fresh water, and has more than one bank of palatable oysters.†

The entrance to port Cornwallis may be recognised as the first opening to the northward of Saddle hill. It is bounded on the north by a reef extending nearly half a mile south-eastward from Ross island, off Hood point, and on the south side by South reef,

* See Admiralty plan of port Cornwallis, No. 837 ; scale, $m = 1.57$ inches.

† At about 1,200 yards above Perseverance (or second north) point on the east side of the harbour, is a spring of fresh water, which in February 1793 yielded 150 tuns a day. Nor was there any diminution in the supply up to the latter part of the dry season. Near Hood (or first north point) is another productive spring.

which is very narrow, and has a depth of $3\frac{1}{2}$ fathoms at its extreme, 7 cables north-eastward of Dundas point.

Atalanta bay is the first bight westward of South or Dundas point, and is a good situation to anchor in during the south-west monsoon. Brush or St. George's islet, is situated nearly mid-channel 2 miles north-west of the entrance to the harbour, which above this, opens out to a sheet of water measuring 2 miles in breadth, and $1\frac{1}{2}$ miles in depth, with excellent anchorage in from 5 to 13 fathoms.

DIRECTIONS.—Approaching the entrance from the southward, no danger need be apprehended, the shore being bold and soundings regular to a distance of $4\frac{1}{2}$ miles off shore.

To the northward of the harbour entrance, dangers extend as far out as a depth of 15 fathoms, particularly a ledge of rocks which dry at half ebb, one mile south-east of Table islands and 7 miles N. by E. $\frac{1}{2}$ E. from the entrance of the harbour; these should be given a wide berth.

To enter the harbour, bring the west extreme of Wharf island, situated a mile north-eastward of the north end of Chatham island, in line with the northern extreme of Chatham island, N.E. $\frac{3}{8}$ E. This mark, given by Lieut. Blair in 1791, leads up the harbour clear of all dangers.

Tides.—It is high water, full and change, in port Cornwallis at 10h.; springs rise $8\frac{2}{3}$ feet.

TABLE ISLANDS are situated about 7 miles northward of the entrance to port Cornwallis, and extend to a distance of nearly 3 miles from the shore, with which they are connected by a reef, the outer edge of which is probably at some distance eastward from the islands, and steep-to. Vessels are recommended to give Table islands a berth of not less than 3 miles and not to stand into less than 25 fathoms, on that part of the coast between cape Price and port Cornwallis.

THE COAST from Table islands, takes a westerly direction for about $2\frac{1}{2}$ miles, forming Cadell bay, in which good anchorage has been reported during both monsoons; it then trends north for about 8 miles, terminating at cape Price, which is the northern extremity of North Andaman island.

Union ledge is the easternmost of the known dangers off the north-east end of North Andaman island. It bears E. by S. $\frac{1}{2}$ S., distant $8\frac{1}{2}$ miles from cape Price, and has over it a depth of 6 feet at low water. It is said to be half a mile in length, and the soundings outside it, though deep, are irregular.

Jackson ledge, about half a mile in length, has also a depth of 6 feet at low water, and lies N.E. $\frac{1}{2}$ E. 6 miles from cape Price. Ranger reef, having over it 4 feet of water, lies $1\frac{1}{2}$ miles north-westward of Jackson ledge. The bottom is uneven, and there are overfalls between Jackson and Union ledges and the north-east coast of North Andaman island.

Pocock island is small, with rocks extending off it, and bears E.S.E. $1\frac{1}{2}$ miles from cape Price.

LANDFALL ISLAND.—Off the north end of North Andaman island are some islands and reefs, the largest of which is Landfall island, which with East island, immediately eastward of it, is situated on a reef, and it is probable that there is no passage between them. Landfall and East island, with their connecting reef, should not be approached nearer than in a depth of 18 or 20 fathoms, particularly in the night, or during thick weather ; each of these islands is about 100 feet high.

Cleugh reef is dangerous, lying midway between Landfall island and the north end of North Andaman. It is just awash, and extends farther to the south than was formerly supposed.

Cleugh passage, between Landfall island and Cleugh reef, off the north end of North Andaman island, was passed through by H.M.S. *Rifleman* in 1878. There is also a passage south of Cleugh reef, but neither should be used if they can be avoided.*

WEST COAST of the Andaman islands has coral reefs more extensive, and forming dangers to a far greater distance from the land, than those on the east coast. Dangerous patches are found at a distance of 20 and 25 miles from the land. Throughout the extent of the Andamans the highest land is on the eastern side, and gradually descends towards the western coast, consequently marshy localities abound on the western side. The hills throughout are covered from summit to base with luxuriant vegetation. The western side is exposed to the full force of the south-west monsoon. Hence the west side of the Andaman islands is by no means a desirable locality, and should be carefully avoided, especially during the season of the south-west monsoon.

CORAL BANKS.—There are three great coral reefs on the western side of the group, namely, West Coral bank, 25 miles in length, N.N.E. and S.S.W. and $3\frac{1}{2}$ miles broad ; Middle Coral bank

* Nav. Lieut. J. Tully, H.M.S. *Rifleman*, 1878.

10 miles in length, oval shaped ; and South Coral bank $8\frac{1}{2}$ miles in length, irregularly shaped. They are all composed of dead coral and sand, with here and there single bunches of live coral one to two feet high. They were carefully examined by Commander Carpenter in the *Investigator* in the year 1888, and their shoalest portions sounded over with a water glass in hand. The water is remarkably clear, and with a water glass every detail of the bottom could be discerned. Judging from the appearance of the bottom and the absence of reef building coral it seems probable that the surface débris of the banks is disturbed by the sand of the sea, and that the rollers topple and break on the middle bank in the south-west monsoon, though they may not do so on the other two banks.

West Coral bank lies 15 miles off the west coast of North Andaman, and from its centre, where the shoalest water is 6 fathoms, rocky bottom, the north peak of Saddle hill bears E. $\frac{1}{4}$ S.

Middle Coral bank, in lat. $12^{\circ} 30''$ N., lying 22 miles N.W. by W. of Spike island, has 23 feet least water, where the rocky strata, which forms the ridge on which these banks stand, just crops up for some 30 yards through the crust of dead coral and sand.

South Coral bank, in lat. $12^{\circ} 15'$ N., lying 14 miles W. $\frac{3}{4}$ N. of Cape Bluff, has 6 fathoms least water on a small brain coral near its centre.

The 100-fathoms line passes close westward of the banks, and the increase of swell will generally give warning of crossing the 20-fathoms line.

In the north-east monsoon they may be safely passed over by vessels of ordinary draught. In 8 fathoms on a calm day the depth looks not more than 20 feet. The navigation inside of the banks to within 3 miles of the shore is quite safe, except on the west side of North Andaman, to which a berth of 5 miles should be given.

Views.—A short description of the distant features of the islands from the vicinity of the coral banks will be useful.

From the centre of West Coral bank, with Saddle peaks bearing East, distant 33 miles, there is no other visible land to be compared with them in height. South of the Saddle the hills fall rapidly to the horizon, above which only a few hummocks are visible as far as Whale mountain (southward of Stewart sound), which stands up alone bearing S.E. by E. On a very clear day East Coast hill may be seen a little to the southward. On a nearer approach to land North Reef island and Interview island appear above the horizon, the latter showing a long level topped ridge.

From the Middle bank on a fine day Saddle peak is well above the horizon, but seldom visible. Whale mountain appears whale backed, bears N.E. by E., and stands alone except for a 700-foot peak east of Interview island, which shows low just to the left of it. To the south of Whale mountain, a high range standing well back, with a sharp peak on the right slope of the highest part, marks East Coast hill. The near range stretching from E. by N. to E.S.E. is the "West Coast" range of Middle Andaman, and where the land falls low at the southern extreme of the range the vicinity of the Middle strait can be recognised.

From the South bank, on a fine day, Whale mountain is the most northern land visible; then comes East Coast peak, still high but very faint; and close to its right West Coast peak and range, which terminates at Spike island, the latter showing from here a small tuft at its northern end. South of Spike island the land continues low, with here and there a small peak until it rises to the high range east of port Campbell.

CAPE THORNHILL, W.S.W. 7 miles from cape Price, has White cliff and Reef islands about a mile west and S.W. of it.

West island, N.N.E. $2\frac{1}{2}$ miles from cape Thornhill, is surrounded by a reef, with numerous patches between it and the shore.

Paget and Point islands, close together, and surrounded by reef, lie about 3 miles south-west of Reef islands.

The west coast of North Andaman island trends south from abreast Paget and Point island, for about 34 miles, to the western entrance of the narrow strait which separates North and Middle Andamans.

This part of the coast is strewn with islands and reefs, for the position of which the chart is the best guide.

Shark islet (formerly named Flat islet), 3 miles off the coast, lies $6\frac{1}{2}$ miles N. by E. $\frac{1}{2}$ E. of North Reef island, and is a small sandy islet standing on a foundation of rock. Its trees are visible 9 miles.

North Reef island, 2 miles square, with a bight on its eastern side, is a low flat wooded marshy island, $4\frac{1}{2}$ miles north of Interview island. A reef projects nearly 2 miles off its south point. Close off the north-east point of this island is Austen, a small wooded sandstone island. There is a channel between the two, but it is narrowed by a spit off Austen island.

Anchorage.—There is good anchorage in 10 fathoms in the bight eastward of North Reef island, and a vessel approaching from the

north-westward should pass round Austen island at a distance of 4 cables, avoiding a shoal that lies $1\frac{1}{2}$ miles N. by E. of Austen island, and also a spit that extends about 3 cables south from the same island. Nicobar pigeon abound.

Interview island, 14 miles long north and south, and 3 miles broad, lying between latitudes $12^{\circ} 46'$ and 13° N., is a level topped wooded island, 370 feet high, situated off the strait which separates North and Middle Andaman. The north point is low and rises gradually to the level ridge; the south point terminates in a cliff, close off which a rocky pinnacle 22 feet high stands in the water. The cliff, whenever the sun is to the southward of it, catches the sunlight, and is thus a useful mark. Reefs extend off the north and south points of the island. One mile S.W. by S. of the south cliff there is a small woody islet named South Reef island. From the latter a stony bank of 3 to 5 fathoms extends $3\frac{1}{2}$ miles to the S.S.E. H.M.S. *Investigator*, in the year 1888, entered the channel east of South Reef island, and anchored near the south point of Interview island, but she passed through muddy water and dangerously irregular soundings indicating rocky bottom. The name of port Andaman, previously given to this locality, is therefore scarcely applicable until this channel has been properly surveyed.

Tuft island, about 5 miles S.S.E. of the south point of Interview island, is a bank of sand about 10 feet high. The large bay north-eastward of Tuft island was examined by H.M.S. *Rifleman*, and found to be choked by reefs, and useless as an anchorage.

The west coast of Middle Andaman island, trends on the whole about S. by W. from Tuft island, for about 28 miles to the west entrance of Andaman strait, and appears bold and precipitous, with off-lying islands termed Hump and Flat, for the position of which the chart is the best guide.

ANDAMAN (MIDDLE) STRAIT—Western entrance.—**Spike island**, shaped like a marline spike, and lying north and south, has its broad end to northward. It covers the gap between Middle and South Andaman and the western entrances of Homfray and Andaman straits, and forms protection to a large sound. Its summit is at its northern end, from which it slopes gradually to its south point, where there is a deep but dangerous entrance into Andaman strait. The western coast of Spike island is faced by a reef and outlying rocks, but the northern side is clear and forms the south side of a good channel into the sound. On the opposite side of the channel there is a rounded knoll, which is one of the

south points of Middle Andaman ; from this knoll the north side of the channel trends north-westward into two small bays. At the outer northern point are some pyramidal rocks, and from these a ledge, which covers at high water, extends southward towards the channel. A small spit projects off the north-west point of Spike island.*

DIRECTIONS.—Approaching the north end of Spike island from the westward bring the northern inner entrance point, at the foot of the knoll, to bear E.S.E., and it should be then just touching the north end of Stoa island, an island inside the sound, with a low mangrove north point. Steer in on this till the north-west point of Spike island bears South, when keep in mid-channel, and, turning southwards round Spike island, anchor in 10 to 12 fathoms off a brown cliff about half a mile down its east coast.

From here there are two passages to the east coast for small vessels, forming between them an island, which may be called *Báratán*, from the name of the tribe living on it. A large stream runs into the north end of the sound.

HOMFRAY STRAIT, the northern of the two, is intricate and rocky, but the depths are good until arriving near the eastern entrance, where there is a broad bar of 8 feet, sand and gravel. Outside this again there is a dangerous shoal which nearly closes the reef off Guitar island. The narrowest part of this strait is about 60 yards, and the bamboo grows plentifully on its banks. The tidal stream is weak.

Tala Kaicha island is the next large island, lying east of Spike island, and two small islands lie off its north-west side, the northern of the two, which has a hill on it, being Stoa island ; the other is a low mangrove island.

Wales reefs.—Rather more than half way down Spike island, and near the south end of Tala Kaicha, a large circular coral reef occupies the centre of the sound. South and west of it are two or three other heads. It is generally but not always visible.

DIRECTIONS for Andaman (Middle) Strait.—After rounding Spike island, north end, haul to the southward and keep in mid-channel for 2 miles until abreast of the south end of the low mangrove island. Now borrow on the eastern shore until the apex of a fine peak to northward comes out to the east of the nearer hills. The

* See Admiralty plan Andaman strait, No. 838 ; scale, $m = 1\cdot5$ inches ; and Admiralty chart, Long island to port Blair, No. 1419.

best channel through Wales reefs is that between a ledge of rocks that only covers at high water, 2 cables N.W. by N. of the south end of Tala Kaicha and the largest coral reef. The apex of the conical peak above-mentioned kept just showing on a N. $\frac{1}{4}$ E. bearing, clear of the hills which form the western side of the large mangrove valley to northward, leads through between the above dangers, each of which has been marked by a perch. When the south extreme of Tala Kaicha bears E. by N. haul out to avoid the rocks off the next island and steer about S.W. for the south end of Spike island. The deepest water now lies against the west side of the sound, which should be followed down. When the island with two small hillocks on it, which marks the west end of the narrows, bears S.E. by E. stand across for it, and passing to south of it, continue in mid-channel through the straits. At spring tides it would be well to avoid the narrows when the current is at its strongest. The stream is slack in the narrows at the same time as high or low water at port Blair. At neap tides it is slack all day. (*See directions for eastern entrance of strait, pages 293, 294*).

THE WEST COAST of South Andaman island, has a southerly trend from Andaman strait, for about 17 miles to the entrance of port Campbell. Cape Bluff, the north-west point of South Andaman island, has a reef extending about a mile north from it, otherwise no dangers appear on the chart of this part of the coast. The cliffs of cape Bluff are visible some distance when the sun shines on them in the afternoon.

PORT CAMPBELL* the entrance to which is in lat. $11^{\circ} 58' N.$, is a fine harbour, and contains excellent anchorage in depths varying from 6 to 13 fathoms, over a bottom of ooze. The vicinity of this port can be recognised in the afternoon by the yellow terraced cliffs which are conspicuous when the sun shines on them. At the entrance are two islets, one on each side, of which that off the west point is named Montgomery, and that off the east Petrie. From these islets, banks extend, contracting the entrance channel to a width of about a quarter of a mile.

The channel being so narrow renders the harbour difficult of ingress and egress to sailing vessels, but the shelter within is perfect, the harbour being almost landlocked, and extending about 5 miles in a S.S.E. direction.

* *See plan of port Campbell, on, Ports on west coast of South Andaman island, No. 898.*

Near Montgomery islet is a native village. Wood and water are abundant.

Tides.—It is high water, full and change in port Campbell, at 8h. 26m.; springs rise 6 feet.

The west coast of South Andaman island extends in a southerly direction from the entrance of port Campbell, for about 20 miles, to the neighbourhood of Labyrinth islands (*see* page 285) and port Mouat. This part of the coast is very little known, and appears to have several salient points fringed with coral reefs and dangers.

Constance bay, formed by Palmer point, is a shoal bay 5 miles northward of port Mouat, with several islets and reefs. A large dry rock lies on the south edge of the reef off Palmer point, and a spit of 3 to 8 fathoms extends 2 miles S.S.W. of the rock.

Tarmugli island, the most northern of the Labyrinth group, has no specially distinctive features, except its south-west point, which is clifty, with one or two dry rocks off it. A reef fringes its north and west sides, being irregular on its western side with outlying patches, and continuous on its northern side with a large field of foul ground extending 2 miles to the northward and culminating in Allen patches, which are only separated from the shoal water off Palmer point by a narrow channel of clear water.

Allen patches have one head of coral, awash at low water springs, which lies 7 cables from their north end.

Currents.—On the west side of these islands in the fine season the surface current runs to the southward for days together, but it occasionally reverses for 24 hours.

PORT MOUAT* is situated north-eastward of the Labyrinth islands, and nearly opposite port Blair on the eastern coast, from the head of which it is distant about 2 miles. This port extends in an easterly direction for about 2 miles, the entrance, between Perseus and Andromeda points being obstructed by Helby rock, a coral head with 12 feet water on it, lying N. $\frac{1}{2}$ E. about half a mile from Andromeda point; and by the reefs stretching off Perseus and Andromeda points. About a mile eastward of the entrance, the harbour contracts to a width of $1\frac{1}{2}$ cables, and the navigable channel to a breadth of little more than half a cable, the depth just here being from 14 to 20 fathoms. Eastward of this, the harbour opens out into a land-locked basin, in which is excellent anchorage of from 4 to $5\frac{1}{2}$ fathoms.

* *See* plan of port Mouat, on, Ports on west coast of South Andaman No. 898; scale, *m* = 3·9 inches.

DIRECTIONS.—When 5 miles from Perseus point, or while the western side of Tarmugli island bears eastward of South, Perseus point should be brought to bear E. by S., and be steered for on that bearing. This course leads between the shoal ground stretching southward from Palmer point and the north end of Allen patches, and should be kept until Grub island, (small, with a high yellow cliff,) is in line with mount Foord, Rutland island, bearing S.S.E. $\frac{1}{2}$ E. course should then be altered to keep these in line, passing between Allen and Hooper patches, until the northern inner entrance point of port Mouat bears E. $\frac{1}{2}$ N., when enter the port with the point on that bearing. Before entering it would be advisable to buoy Helby rock.

The chart of Port Mouat should be used with caution until an exact survey of the locality has been made.

Tides.—It is high water, full and change, at port Mouat at 8h. 40m.; springs rise 5 feet.

For description of North Sentinel, Rutland island, and contiguous coast, *see* pages 286, 284, &c.

COCO CHANNEL between Landfall island of North Andaman island and Little Coco island, is 10 to 50 fathoms in depth. The bottom is of coral, with occasional patches of sand and mud. During the north-east monsoon the current sets frequently through the Coco channel to the north-west; but in the south-west monsoon it flows mostly to the eastward. In settled weather, the tidal stream sets, flood to N.N.E., ebb to S.S.W.*

COCO GROUP† consists of three islands, Little Coco, Great Coco, and Table island; the first is the southernmost of the group, and lies about 23 miles N.N.E. $\frac{1}{2}$ E. from Landfall island of North Andaman island.

Little Coco island is densely wooded, the tops of the trees being 250 feet above the sea in its middle and southern parts, and about 200 feet at its northern end. The island is surrounded by a coral reef, which extends only a short distance from its eastern and western sides, but at the north end of the island the reef stretches off half a mile, with irregular soundings for more than a mile northward of its edge. The reef also extends about half a mile from the south-west point, and foul and uneven ground continues for 4 miles southward of the island.

* Horsburgh, eighth edition, vol. 2, page 701.

† The description of the Coco group is by Commander R. F. Hoskyn, R.N., in charge of Marine Survey of India, 1890. *See* Admiralty Chart:—Andaman islands, No. 825.

A belt of cocoanut trees surrounds the island, and there is a lagoon at its southern end, but the water is not drinkable. There are a few wild pigs on the island.

Anchorage.—During easterly winds, good anchorage in 9 to 12 fathoms, sand and mud, with smooth water, may be found in Lambert bay on the west side of the northern part of the island. The water there shoals gradually; on the eastern side of the island the bottom is rocky and foul.

South patch, of coral, on which $7\frac{1}{2}$ fathoms was the least depth found, lies S. by E. $3\frac{3}{4}$ miles from the south point of Little Coco. There may be less water on this patch. Vessels should pass southward of South patch.

Daphne rock is a small coral patch with a depth of $2\frac{3}{4}$ fathoms on it, lying $2\frac{1}{2}$ miles S. $\frac{1}{4}$ W. from the south point of Little Coco.

Middle rock, with less than 6 feet water on it, lies 2 miles S. $\frac{1}{2}$ W. from the same point, between which and Middle rock the ground is uneven, with rocky patches awash 6 cables south of the island.

Investigator patch, on which there is a depth of as little as $1\frac{1}{2}$ fathoms, is an extensive area of shoal and rocky ground, lying 2 miles E.S.E. from the south point of Little Coco.

GREAT COCO ISLAND is north-eastward of Little Coco, with the deep Alexandra channel intervening. This island rises very steeply on its western side and slopes gradually to the eastward; the summit, 366 feet above the sea, is in the northern part. The eastern slopes are all densely wooded, and there are a few bare patches on the western side. No detached dangers lie off this island, but rocky and foul ground extends 4 cables from its north-west and 2 cables from its north points. A reef projects one mile southward of the south point, with Jerry island, wooded and 97 feet high, near the extremity. Rocky and uneven ground stretches southward of Jerry island, and vessels passing southward of Great Coco should not approach within a mile of Jerry island.

Peechee point, one mile S.E. from the north point of Great Coco, is a bluff 150 feet high, surmounted by an old wooden house, a flagstaff and a few trees, and is connected with the mainland by a low neck. About one mile S. by E. of Peechee point is Rat island, small, wooded and 125 feet high, with reefs extending 2 cables seaward and others connecting it with the mainland.

Ford bay anchorage, between Peechee point and Rat island, affords good shelter with strong westerly winds, in 7 to 10 fathoms, sand and mud, with Rat island South about three-quarters of a mile distant.

Supplies.—There are many wild cattle on Great Coco, but they can only be shot with difficulty, as the jungle is almost impenetrable. A belt of cocoanut trees surrounds the island, and there is a small fresh water lagoon on the low neck connecting Peechee point with Great Coco.

Table and Slipper islands* stand on the same reef northward of Great Coco, from which they are separated by Marshall channel, 8 cables in width between the projecting reefs, with depths of 5 to 7 fathoms.

Table island, 150 feet high and densely wooded, except on its south-western side, presents a flat level surface with steep sides on all bearings.

Slipper island, north-westward of Table, is 113 feet high, small, grassy and with a few trees near the summit. A remarkable pillar rock is situated near its western extreme.

The surrounding reef projects three-quarters of a mile from Slipper island in a north-westerly direction, half a mile from the north point of Table island, and 3 cables from the south point of that island. Irregular soundings, causing tide ripples and swirls, were found for $4\frac{1}{2}$ miles E.N.E. of Table island. Vessels are warned to avoid this neighbourhood.

LIGHT.—On a grassy ridge, on the south-west and highest part of Table island, a *fixed white* light, elevated 195 feet above high water, and visible from a distance of 22 miles, in every direction except when bearing between N. by E. and N. by W. $\frac{1}{4}$ W. and between N.N.E. $\frac{3}{4}$ E. and N.E. $\frac{1}{2}$ N., is exhibited from an iron circular tower, 91 feet high, and painted in red and white alternate bands.

Anchorage and Landing places.—In the north-east monsoon the anchorage is on the south side of the island, with the lighthouse bearing N. by E., and at about 3 cables offshore, in a depth of 10 fathoms, rock bottom. In picking up this anchorage care must be exercised so as not to be too close to the reef, nor so far out as to be in the strength of the stream. The landing place is on the rocks immediately under the lighthouse; it is not a convenient one, but is better at high than at low water.

* See Plan of Table island on Admiralty Chart, No. 825.

During the south-west monsoon the anchorage is on the north side of the island, at about 4 cables off shore, in a depth of 9 to 12 fathoms, sand and rock, with the lighthouse bearing South. This is at best an exposed position, and the landing place, marked by stakes on the reef, is a bad and dangerous one, except in fine weather. When a vessel anchors the light-keeper indicates whether landing is dangerous or not.

Supplies.—There are many wild cattle on Table island, but they are difficult to shoot. A few cocoanuts can be obtained. The supply of vegetables and water is only sufficient for the light-keeper's use.

Tides.—It is high water, full and change, at Table island, at 9 h. 53 m. Springs rise $8\frac{1}{4}$ feet, neaps $5\frac{3}{4}$ feet, and neaps range $2\frac{3}{4}$ feet. The flood stream runs to the eastward, the ebb to the westward; and in settled weather the streams appear to turn at high and low water. The tidal streams run upwards of 5 knots in Marshall channel, and about 2 knots past the north and south ends of Little Coco. Even in fine weather there are formidable looking tide rips off all the salient points, especially in Marshall channel, at both ends of Little Coco, off the north-west point of Table island, and south of Jerry island.

CHAPTER VIII.

PREPARIS CHANNELS AND GULF OF MARTABAN TO TAVOY
RIVER.

 VARIATION 3° E. IN 1892.

PREPARIS SOUTH CHANNEL, separating Table island of the Coco group, from Preparis island, is about 35 miles in width and has near its central part depths of 109 and 150 fathoms, over a bottom of coarse sand. This channel is often made use of by vessels working down the bay of Bengal against the south-west monsoon from Calcutta and intending to pass eastward or to leeward of the Andaman islands; Table island, with its light, affording a good mark for verifying the reckoning and for taking a fresh departure.

Preparis island, the north point of which is in lat. $14^{\circ} 54\frac{1}{2}'$ N., long. $93^{\circ} 41'$ E., is situated nearly midway between the Great Andaman island and the coast of Pegu. Its north point is distant 55 miles S.S.W. $\frac{1}{2}$ W., from Alguada lighthouse, and 46 miles N. by E. $\frac{3}{4}$ E. from the lighthouse on Table island.*

Preparis island is $4\frac{1}{2}$ miles long N.N.E. and S.S.W. by about three-quarters of a mile in breadth. It is 265 feet in height, covered with wood and slopes gradually to the sea. The east side of the island is steep, there being a depth of 10 fathoms about half a mile from the shore, rapidly deepening to 17 and 22 fathoms. A reef fringes the island and extends from the south point for $3\frac{1}{2}$ miles in a southerly direction. The island was uninhabited in 1887. Many monkeys were then seen there, and a few turtles.

A rock awash at low water, bears about S.E. by S. from the north-east point of Preparis island; distant about a quarter of a mile from the shore.

Detached reefs.—On the west side of Preparis island, a reef with some islets, about 90 feet high, upon it, has its outer edge $2\frac{3}{4}$ miles distant from the island; in the narrow channel between this reef and the island, the depths are 9 to 15 fathoms. There is also a reef on the south-west side of Preparis island, having at its north end a pinnacle

* See Admiralty chart of Preparis North Channel No. 152, scale, $m = 0.25$ inches.

rock, 40 feet high, and at its south end a small dangerous rock only 6 feet high ; this reef is surrounded by a bank of from 6 to 10 fathoms, and its south end is S.S.W. $\frac{3}{4}$ W., $6\frac{3}{4}$ miles, from Preparis south point.

Cow and Calf islets, cliffy, flat-topped, close together, and 77 feet high, bear from the north point of Preparis island N. by E. $\frac{1}{2}$ E. about $1\frac{1}{2}$ miles ; a bank of 6 to 8 fathoms, extends from them nearly 2 miles in a south-east direction. A narrow channel, in which are depths of from 11 to 24 fathoms, separates these islets from Preparis island.

Anchorage at Preparis island, during the south-west monsoon, is on the eastern side, in 12 to 14 fathoms ; or nearer the island at half a mile from the shore in 8 or 9 fathoms, sand, coral, and shells ; with eastern extreme of Cow island N. 5° E. and south point Preparis island S. 40° W. Anchorage may also be found on the western side during the north-east monsoon.

Water.—On the east side of Preparis, at a few paces from a sandy beach, formed between two ledges of rock, where boats can land with safety there is a pond of fresh water, convenient for watering ; from it the highest part of the island bears N.W. The sands at the north-east corner of the island abound with turtle.

PREPARIS NORTH CHANNEL separating Preparis island from Alguada reef of the Pegu coast at the entrance of the gulf of Martaban, is about 53 miles in width and has depths of from 19 to 24 fathoms at 20 miles S.S.W. of Alguada reef, deepening to 30, 40, and 45 fathoms as Preparis island is approached.

Thalia shoal the least water found on which was 10 fathoms, coral bottom, is about $1\frac{1}{2}$ miles in extent N. by W. and S. by E., and bears N. $\frac{7}{8}$ E. $21\frac{1}{2}$ miles from the north point of Preparis island, or is situated in about lat. $15^{\circ} 15' N.$, long. $93^{\circ} 46' E.$ The depths around Thalia shoal vary from 24 to 46 fathoms, the bottom generally consisting of gray sand and coral.

The 100 fathoms line, so far as has been ascertained, appears to run almost due north from Preparis island, to a position about 25 miles westward of cape Negrais of the Pegu coast, and to be subject to but slight indentations.

ALGUADA REEFS,* bounding the north side of North Preparis channel, are about $1\frac{1}{2}$ miles in length north-east and south-west, and are nearly awash at high water springs.

LIGHT.—From a granite tower, 160 feet high, situated near the south-west part of Alguada reef, a *revolving white* light attaining its

* See Admiralty Chart :—Bassein river and approaches, No. 834.

greatest brilliancy *every minute*, is exhibited at an elevation of 144 feet above high water, and should be visible in clear weather 18 miles. The lighthouse is coloured black and white in horizontal bands.

Position.—This lighthouse is situated in lat. $15^{\circ} 42' 30''$ N., long. $94^{\circ} 12' 7''$ E. (approximate); and bears S.S.W., $10\frac{1}{2}$ miles from Diamond island flagstaff at the entrance of Bassein river.

Dangers.—There are detached sunken rocks at a considerable distance from Alguada reef. One patch, with $2\frac{1}{4}$ fathoms on it, lies about $1\frac{1}{4}$ miles south of the lighthouse, and there are several very shoal patches to the northward of the reefs; Hugh Rose rock, the northern and shoalest of these, is awash at low water.

DIRECTIONS.—Although the lighthouse is an excellent mark for the reef, vessels should not approach it from the southward or westward nearer than 3 miles, or in less water than 15 fathoms. A vessel's position cannot be fixed by cross bearings when rounding the reef, but as long as the angle of elevation of the lighthouse, from vane to base, is less than $30'$, a vessel will be at least 3 miles from the lighthouse. The high land of Hain ji island well open eastward of Diamond island leads well eastward of Alguada reef; and also leads eastward of Phaeton shoals.

Tides.—It is high water, full and change, in the Preparis North channel at about 9h. 30m.; during the north-east monsoon the tides there are very irregular. At springs, the flood stream sets S.S.E. and S.E., and the ebb S.W., with a velocity of about 2 knots. During neaps there is a constant set to the south, of from one to $1\frac{1}{2}$ knots an hour.*

IRRAWADDY RIVER, the total length of which is about 900 miles, rises in the southern slopes of the Patkoi mountains, one branch, in lat. $27^{\circ} 43'$ N. long. $97^{\circ} 35'$ E., and another farther to the eastward. These two, known as the Large and the Small river respectively, unite in about lat. 26° N. Its general course which is tortuous as far south as lat. 17° N., is from north to south. At Akauktang the river enters the delta, hills giving place to alluvial plain, protected on the west by extensive embankments. It reaches

* We found the ebb set for 6 hours to N. by E. at one-half to three-quarters of a knot, at neaps. (Commander A. Carpenter, R.N., in charge of India Marine Survey. April 1886.) In December 1885, H.M.S. *Ranger*, when less than 60 miles westward of Diamond island, up to her anchorage at that place, experienced a current running at the rate of 2 knots to the west-north-west. The effect of the easterly flood stream was not felt. It is reported that, after easterly winds, the current sets to the westward continuously, along the north shore of the gulf of Martaban.

the sea by nine principal mouths, viz., the Bassein, (and its eastern entrance the Theknge thaung), Ywe, Pyamalaw, Irrawaddy, Kyondon, Pyapon, To or China Bakir and the Rangoon. Some of these are of considerable breadth, but the Bassein and Rangoon mouths are the only ones at present used by seagoing ships. The Irrawaddy mouth in long. $95^{\circ} 3'$ E. is said to be the straightest channel to the sea; it has a depth on the bar of 12 feet at low water springs; but is seldom used as there is no town at the entrance.*

The Irrawaddy delta is constantly encroaching on the sea, owing to the immense quantity of silt brought down by the river, and is cut up into many low islands by numerous tidal creeks and channels. Scattered along the south parts of these are temporary villages, occupied during the dry season by salt boilers and makers of *nga pi* or fish paste.

(For inner navigation of the Irrawaddy river, *see* page 334).

BASSEIN RIVER† is the most westerly of the channels by which the Irrawaddy reaches the sea. It is connected with the other mouths by numerous large tidal creeks, and is navigable for a considerable distance inland. The banks are for the most part low and covered with thick jungles. The river is about 12 miles wide at the entrance between Pagoda and Purian points, but its breadth soon decreases to $2\frac{1}{2}$ miles at the north end of Hain ji island, and continues to decrease, being only 2 cables wide off the town of Bassein.

Bar.—Least depth in fairway.—The least depth to be passed over by a vessel between the sea and Bassein, is about 23 feet at low water springs, and 28 feet at high water neaps; situated on the bar 2 miles northward of Diamond island. In 1890 the depth at the entrance of Elbow reach, 35 miles above Hain ji, was 21 feet at low water springs, but this is subject to change. A vessel of 26 feet draught has entered the port of Bassein. The channel within the bar is, in some parts, constantly altering; and this fact, as well as the numerous shoals and rocks, makes the navigation difficult for a stranger.

Pilots can always be obtained at Diamond island, and for the above reasons one should, if possible, be taken.

Alguada reefs and light.—*See* page 313.

* Commander H. H. Edwards, R.N., H.M.S. *Ready*, 1881.

† *See* Admiralty chart, Koronge island to White point, No. 823; and Bassein river, No. 834; scale, *m* = one inch.

Phaeton shoals, lying midway between Alguada reefs and Diamond island, cover an area $2\frac{3}{4}$ miles long by $1\frac{1}{2}$ miles wide, and have several rocky patches with $2\frac{1}{4}$ and $2\frac{1}{2}$ fathoms water on them.

Caution.—Vessels should not attempt to pass between Alguada reefs and Diamond island, as the locality is dangerous.

Mawdeng (Pagoda point), the western entrance point of the river, is flat in appearance, about 100 feet high, and terminates in a bluff with rather bare sides, steepest to the south-west. The great pagoda, on the extremity of the point, is 144 feet high, and shows above the trees near it. A reef, the outer part of which covers at half tide, extends a quarter of a mile off Pagoda point. A small obelisk, 9 feet high, is situated on this reef, near the south-east extreme of the point. Eastward of this obelisk there is good landing and shelter for boats in the north-east monsoon; and good fresh water may be obtained from the well at the bottom of the steps leading to the pagoda.

Diamond island $5\frac{1}{4}$ miles S.S.E. from Pagoda point, fronts the entrance to Bassein river. It is flat in appearance, wooded, and 116 feet high. On the east side is a flagstaff, 144 feet high, a telegraph house with arched verandah; and the Pilot's bungalow, the only house seen from the southward, on the next hillock south of the flagstaff. In the north-east monsoon landing may be effected in the little bay on the east side of the island. In the south-west monsoon landing is often impracticable. Shoal water extends $3\frac{1}{2}$ cables from the eastern side of Diamond island.

Turtles frequent the island at all times, but being a government monopoly they must not be taken or disturbed.

Telegraph.—**STORM SIGNALS** are shown from the flagstaff on Diamond island. For signals, *see* page 27.

This staff has telegraphic communication with the Indian system.

Baroni rock, lies half a mile N.E. $\frac{1}{2}$ N. from the north end of Diamond island, and is the extreme of the shoal water stretching northward from that island. This rock has 16 feet over it at low water. Alguada lighthouse well open eastward of Diamond island, S.S.W. $\frac{1}{4}$ W., leads eastward of Baroni rock; and cape Negrais shut in by Pagoda point, leads northward of the rock.

Outer anchorage.—There is good anchorage in the north-east monsoon about three-quarters of a mile eastward of Diamond island, in about 5 fathoms, with Diamond island flagstaff W. $\frac{1}{2}$ N., and

Hain ji summit N. by E. $\frac{1}{4}$ E. Anchorage may also be obtained in 9 fathoms, mud, north-westward of the island, with the north point S.E., and Hain ji summit N.N.E. $\frac{1}{4}$ E.

Prohibited anchorages.—To protect the telegraph cable laid from Diamond island to the northward, anchorage is prohibited with the centre of Diamond island bearing between S. by E. and S. by W. Also in Gnaputau reach, about 15 miles below Bassein, vessels should not anchor between the telegraph houses, which are painted white, and situated one on each side of the river.

Hain ji island, within the mouth of Bassein river, and on the western side, is triangular in shape; it is rendered conspicuous by a hill near its N.E. end, which is 445 feet high, densely wooded, and slopes away to the southward. The rest of the island is flat and covered with jungle about 35 feet high. A round tree, 72 feet high, on the south-east point of the island is a useful mark in going up the river. A rocky patch, part of which is dry at high water, lies with its south extreme about S.S.W., three-quarters of a mile from the S.E. point of the island. Boats only can navigate the channel westward of Hain ji at high water. The inhabitants of the village at the north end of the island are chiefly employed in fishing and manufacturing fish paste. Good water can be obtained at the village.

Wolf rock dries at low water, and lies 4 cables from the eastern side of Hain ji. A beacon, 16 feet high, and surmounted by a diamond-shaped cage, painted white, marks the rock. Shoal water extends 3 cables eastward of the beacon.

Purian point on the east side of entrance to Bassein river bears E. by S., about 7 miles from Diamond island. It is low like all the eastern shore of the river, but near its extremity has a grove of trees, 75 feet high, showing above the ground northward. White sandstone cliffs about 10 feet high extend $1\frac{1}{2}$ miles north-eastward from the point. A patch of reef, which dries 6 feet, lies nearly one mile S.S.W. of Purian point, and rocks stretch off its south-west and west sides.

Martin rocks, 4 feet high, and dark and jagged in appearance, lie one mile N.W. $\frac{1}{2}$ N. from Purian point; and on the coast abreast these rocks white sandstone cliffs, 30 to 45 feet high, extend for $1\frac{1}{4}$ miles, and are then lost in the jungle.

Orestes shoal, lying between Pagoda point and Diamond island, has 18 feet over it at low water, and is about half a mile in extent.

Buoys.—The Fairway buoy (black and white chequered) is moored in about $5\frac{1}{2}$ fathoms at low water, one mile N.E. of the north-east point of Diamond island.

A red buoy, moored in $5\frac{1}{2}$ fathoms, $1\frac{1}{2}$ miles N. E. by E. $\frac{1}{2}$ E. from Orestes shoal, marks the entrance to the river. A black buoy in 5 fathoms lies E. by N. $\frac{3}{4}$ N., nearly $1\frac{1}{2}$ miles from the red buoy, and marks the 5 fathoms edge of the shoal water that extends from the coast northward of Purian point.

Burgess rock-buoy.—Burgess rock, with a depth of 18 feet over it, lies on the eastern side of the channel between Hain ji island and Ward point. A buoy, painted black and white in vertical stripes, is moored half a cable northward of the shoalest part of the rock; foul ground extends $1\frac{1}{2}$ cables southward of the buoy, and half a cable northward of it. Ships should not pass near, nor to the eastward of this buoy.

Tides.—It is high water, full and change, at Alguada reef at 9h. 36m.; spring rise $8\frac{1}{2}$, and neaps 6 feet. The streams are irregular, being much influenced by the winds, especially at neaps. The flood stream usually runs about S.E., and the ebb N.W. In the north-east monsoon, at springs, the ebb stream begins about 2 hours after high water and runs until low water, at a rate of one to 2 knots an hour, the period of slack water being very short. In December, 5 miles westward of Diamond island, the stream set to the westward at from half a knot to 2 knots an hour, for 24 hours; with an easterly wind, force 2 to 3.

One mile northward of Diamond island the tidal streams at springs are circular; the flood commencing to run S.E. by S., turning through east, and ending at N.E. by E.; the ebb beginning to run N.W., turning through west, and ending at S.W. Both streams are strongest in the second and third quarters, running then $1\frac{1}{2}$ knots an hour.

Near the bar the flood runs about East, and the ebb S.W. by S., one to 2 knots at springs.

DIRECTIONS.—Vessels approaching Bassein river usually pass westward of Diamond island, and in doing so should give it a berth of at least a mile to avoid the dangers on that side. Pilots come off from the east side of the island on the usual signal being made. Vessels from the westward, bound to the anchorage eastward of Diamond island, should proceed to the northward until the Fairway buoy bears southward of E. by S. $\frac{1}{2}$ S., when course may be altered for the buoy, taking care not to bring it eastward of that bearing, to

avoid Baroni rock. When about a cable from the Fairway buoy, or when Alguada lighthouse opens well eastward of Diamond island, the anchorage eastward of Diamond island may be steered for. To enter the river (1890); in a position about three-quarters of a mile north-west of the Fairway buoy, bring Hain ji island summit to bear N. by E. $\frac{3}{4}$ E., or, if it is visible, in line with the sand cay southward of the island. This leads over the bar, in 23 feet at low water; and the summit of Hain ji should be kept on this bearing until Pagoda point bears W.N.W., when course should be altered to N.N.E. $\frac{3}{4}$ E. to pass westward of Burgess rock. Above Hain ji island it is strictly pilotage water, and consequently directions will not be given.

Between the river entrance and Bassein town.—Dalhousie point, $2\frac{1}{2}$ miles northward of Ward point, is a bluff about 40 feet high with pagodas on it.

The northern part of Long sand, eastward of Stony point, is now (1890) covered with trees about 25 feet high, and they are said to be extending southward.

Travers islands are each about 50 feet high, and are connected at low water. South Travers island has a thin clump of trees on its summit, which is remarkable from the southward. On a partial examination of Ridge shoal, the only shoal water found was close westward of the northern red buoy. The least water immediately between the buoys was $5\frac{1}{2}$ fathoms. Sesostris rocks are marked by a red conical buoy; there is shoal water $1\frac{1}{2}$ cables southward of the buoy. The whole of Enterprise island should be kept open eastward of Clear point when passing this buoy.

There is deep water close to the river bank eastward of Alexander rock. The south-east side of Enterprise island has shallow water off it.

Pariah rock is always covered. A red buoy is moored $1\frac{1}{4}$ cables N.N.E. of the rock, and a group of whitewashed trees stands on the bank abreast the rock.

BASSEIN TOWN, 75 miles from the mouth of Bassein (Ngawun) river, and situated in the middle of a fertile rice growing district, is resorted to principally between January and September, (March being the busiest month), for the shipment of that grain for Europe. The town stands on the left bank of the river, and on a slight eminence, the Shwemu htau pagoda rises from the centre of a fort, within which are the Courthouses and Treasury. Across the river is the small Theng bhaw gzen suburb containing the rice mills and store yards of the principal merchants. Vessels of any draught

can load alongside the mill jetties. A port officer resides here. The population is about 30,000; and in the early part of the year about 2,500 come in for work at the mills.

Climate of Bassein is relaxing, owing to the situation of the town in the delta of the Irrawaddy, and to the muddy banks of the river and creeks, which are exposed during the greater part of the day. In 1876 the total rainfall was 104 inches; of this 11 inches fell from January to May, 83 inches from June to September, and 10 inches from October to December.

Health.—There is a hospital for Europeans, and also one for natives, in the town. Cholera is the only formidable disease, and prevails mostly from February to May; pure water, and a strictly wholesome diet, are the only safeguards against it. All drinking water should be boiled. Smallpox is never widely epidemic as the Vaccination Act is in force.

Coal.—A small supply only is kept by the Irrawaddy Flotilla Company, for its own steamers.

Supplies.—Beef of good quality can be cheaply bought; vegetables are usually scarce and expensive.

Trade.—The total annual tonnage of shipping entering at Bassein varied, during the 10 years ending 1890, from 50,000 to 130,000 tons. In the year 1889–90 the port was entered by 36 steamers and 32 sailing vessels.

The exports in 1889, consisting chiefly of rice, with small quantities of timber, horns and hides, were valued at £608,827. The imports, coal from Australia and Bengal, gunny bags, salt, cocoanuts and piece goods, were valued in that year at £20,785.

Repairs to small steamers and to wooden vessels of about 100 tons can be undertaken by the St. Peter's Institute workshop (Roman Catholic Mission). There is a small dock capable of taking craft of about 80 tons, and a pair of sheers which can lift 6 tons. Heavy repairs could be sent to Rangoon.

Communication.—There is regular tri-weekly communication with Rangoon by the steamers of the Irrawaddy Flotilla Company—time of journey about 26 hours. The telegraph station is on Diamond island at the mouth of the river, and is connected with the Indian telegraphic system.

COAST OF PEGU.—The north shore of the gulf of Martaban extends eastward from the mouth of the Bassein river in an easterly direction for about 70 miles, or to the vicinity of the Krishna shoal,

and then trends to the north-east for about 120 miles to the head of the gulf into which flows the dangerous bell-mouthed Sittang river. The coast of Pegu, in which is comprised the delta of the Irrawaddy, is low and wooded, and no marked feature is discernible from outside the extensive shallow bank known as the Baragua flats, which front it.

Baragua flats.—From the entrance to Bassein river the 5-fathoms edge of the coast bank trends E.S.E. for about 50 miles, then E. $\frac{1}{3}$ N. 27 miles, and then in a curve to the north-east, to the head of the gulf of Martaban. Inside the 5-fathoms line vessels should not venture, until they reach the vicinity of Rangoon river; but while westward of Krishna shoal, should keep in at least 10 fathoms. Baragua flats extend many miles from the land, which is not visible from their southernmost part. Opposite the main entrance to the Irrawaddy, the 5-fathoms line extends farthest seaward, or to lat. $15^{\circ} 30' N.$ No part of the bank between Bassein river and Krishna shoal is marked by buoys.

KRISHNA SHOAL is a narrow ridge 13 miles in length N.E. and S.W., and its widest part about 3 miles across, having depths of 8 to 15 feet, hard sand, and is separated from the east side of Baragua flats by a channel $3\frac{1}{4}$ miles broad, and from 3 to 4 fathoms deep. This shoal is a danger to vessels bound to Rangoon from the westward, should they venture too far to the northward.

LIGHT VESSEL.—In August 1877, the iron lighthouse which marked the Krishna shoal was swept away in a storm. A light vessel is now moored at about 5 miles eastward of the S.W. extreme of the shoal, or in about lat. $15^{\circ} 36' 15'' N.$, long. $95^{\circ} 34' 30'' E.$; and shows at an elevation of 50 feet above the sea a *flashing white* light, showing a *double flash* every *thirty seconds*, visible in clear weather 10 miles. A blue light, the glare visible in clear weather for 20 miles, is burnt every half hour, between 7 p.m. and 5 a.m. The light vessel is painted red, and on the middle or lantern mast carries a red ball by day.

Fog signal.—During thick or foggy weather, a signal gun is fired every half hour.

CHINA BAKÍR LIGHT, on iron piles, stands on the edge of China Bakír flats, and exhibits at an elevation of 74 feet above high water, a *fixed* and *flashing white* light showing a flash *every minute*, visible between the bearings of N.E. by E. $\frac{3}{4}$ E. through north and S.W. $\frac{1}{2}$ S. for a distance of 15 miles. The lighthouse is painted red, with white top or lantern. Position lat. $16^{\circ} 16' 35'' N.$, long. $96^{\circ} 11' E.$

China Bakir flats, which dry at low-water springs, extend along the shore from the mouth of China Bakir river to Elephant point. Their outer or eastern edge is marked by three red buoys (see page 328).

DIRECTIONS for approaching Rangoon river.*—Vessels bound to Rangoon from the westward should pass about 5 miles southward of Alguada reefs lighthouse, then steer to pass about 7 miles southward of the edge of Baruga flats, in 10 to 12 fathoms, and when eastward of the southern extreme of the flats, course may be altered to sight Krishna light-vessel, taking care not to shoal the water to less than 9 fathoms until the light bears southward of west. Leaving the Krishna light-vessel about 5 miles westward, a course may then be shaped to make China Bakir light, observing that between these lights the water should not be shoaled to less than 8 to $8\frac{1}{2}$ fathoms at high water.

Should a vessel working up the gulf make China Bakir light bearing eastward of N.N.E., she should at once haul to the south-eastward; and, until the light bears westward of north, it should not be approached nearer than 4 miles.

During the months of February and March, when thick fogs prevail, great caution is necessary in approaching the entrance of Rangoon river, as there is not a sufficiently marked change in the soundings in the channel to enable the navigator to form an opinion of his position by the lead. By day a vessel should not attempt to enter the river without first sighting China Bakir lighthouse. During the rice season, January to May, the vessels at anchor outside the river will be a guide.

Vessels from the eastward should keep in $5\frac{1}{2}$ or 6 fathoms (low water) until within the limits of visibility of the China Bakir light, and should on no account, in thick weather, attempt to proceed, after running their distance, until China Bakir light is seen.

Caution.—In rounding Baragua flats, especially at night and during spring tides, sound frequently, do not shoal to less than 10 fathoms at low water, and in shaping course, study the time of high or low water, making allowance for an indraught on the flood tide into the mouths of the Irrawaddy. The ground log should be used.

* Information has been received that the soundings in the area bounded by lats. 15° N. and $15^{\circ} 30'$ N., and longs. 96° E. and 97° E., are considerably less than shown on the Admiralty charts. Probably the 20 fathoms line extends nearly as far southward as 15° N. between 96° E. and 97° E.

Mariners should also bear in mind that high water occurs at Alguada reef nearly $4\frac{1}{4}$ hours earlier than at China Bakir lighthouse, a fact to be remembered when calculating the time of the turn of the stream in any position between those places.

In either monsoon China Bakir light should be made if possible between the bearings of N. by E. and W. by N. The coast at the entrance of the river being very low is not visible from seaward until a vessel is in $4\frac{1}{4}$ to $4\frac{1}{2}$ fathoms at low water, or about 7 miles from the shore. Caution is necessary to avoid being set to the eastward of Rangoon river, as the flood tide runs very strongly over the sands at the entrance of Sittang river.

Outer anchorage.—If of moderate draught, after making China Bakir light, steer to the north-eastward until the light bears W. by S., distant about 5 to 6 miles, then anchor in about $3\frac{1}{2}$ fathoms at low water until daylight.* Vessels drawing upwards of 18 feet should anchor in a depth of 27 feet at low water, with China Bakir light bearing N.W. distant 5 miles.

TIDES.—Between Alguada reef and the entrance to Rangoon river, the general set of the flood tide is to the eastward, following the trend of the edge of Baragua flat. At springs, during the north-east monsoon, it sets at the rate of 2 to 4 knots, increasing in strength as a vessel goes farther east. The ebb stream is stronger than that of the flood. Occasionally in October and November a steady set to the westward is experienced, quite overcoming the flood stream. During the months of November, December, and January there is little or no flood stream felt south of Alguada reef except at spring tides.

Winds.—At the entrance of Rangoon river in the month of December the wind is north-easterly, veering to the eastward and blowing fresh during the day; the weather is generally fine. In January the wind is more to the northward, and sometimes blows strong from the eastward for several days; towards the end of the month light land and sea breezes commence; the atmosphere is thick and hazy. In February the land and sea breezes are regular, the latter being fresh near the shore; thick fogs prevail during the whole of the month. In March light land and sea breezes continue, and the weather is foggy. At the period of spring tides the sea breeze is generally strongest.

* See Admiralty chart:—Rangoon river and approaches, No. 833, scale, $m = 1.35$ inches.

From December to March the temperature ranges from 71° to 80° in the shade.

The south-west monsoon commences about the middle of April, and after a few days of storm the weather is clear until the beginning of May, when the monsoon has fairly set in, and continues with breaks of a few days of fine weather until the end of October.

China Bakir river.—For description, *see* page 337.

RANGOON RIVER (*Meyit maka Chaung*), a branch of the Irrawaddy, rises in the mountainous district of Prome in Upper Burma, in lat. 18° 50' N., long. 95° 25' E., and for a distance of 150 miles, flows in a S.S.E. direction nearly parallel to the main stream of the Irrawaddy. At about 50 miles from its mouth it takes a more easterly direction, and under the name of Hlaing river is joined by several large creeks, the chief of which are Panhlaing creek, Pegu river, and Bassein creek. Rangoon river enters the gulf of Martaban in lat. 16° 28' N., long. 96° 20' E., after a course of about 200 miles. The land at the entrance is low, and for the most part covered with jungle to the water's edge, forming mangrove and tidal forests, and there is but little cultivation. Owing to the great rise and fall of tide, and velocity of the tidal stream, the water is charged with a large quantity of deposit, causing the river to present a deep yellow hue.

CAUTION.—The changes in the depths and positions of the banks in Rangoon river and its entrance are so frequent that the charts or directions can never be absolutely relied on. The buoys and light-vessel are moved as necessary to mark the channels.

Least depth in fairway.—The least depth to be passed over between the sea and Rangoon is about 15 feet at low water, situated northward of Hastings shoal just below Rangoon. The depth there however is subject to change. In the dry season, December to April, vessels of 26 feet draught can reach Rangoon at high water springs, and in the rainy season vessels of any draught. At high water neaps vessels of 24 feet draught can navigate the channel. The deepest draught vessel that had visited Rangoon to 1891 was of 27 feet draught.

PILOTS.—The Pilot brig, painted white, and carrying a red and white horizontally striped flag, is usually 8 to 9 miles eastward of China Bakir lighthouse; a pilot will be sent from her to any inward bound vessel that has the pilot jack flying. At night the Pilot brig shows the following distinguishing lights:—

(1.) When at anchor on her station on pilotage duty she shows at the starboard foreyard-arm a *white* light, visible all round the horizon from a distance of at least one mile; and also exhibits a flare-up light or lights at short intervals, which will never exceed 15 minutes.

(2.) When underway, and on her station on pilotage duty, she shows at the main-topgallant masthead a *white* light, visible all round the horizon, and also exhibits a flare-up light or lights as in (1).

(3.) When not engaged on her station on pilotage duty, she shows lights similar to those of other vessels.

Strangers are advised to take a pilot.

EASTERN GROVE LIGHTHOUSE on the point of the same name forming the eastern entrance point to Rangoon river, stands seaward of high water mark, and the lighthouse is similar in structure and colour to China Bakir lighthouse, from which it bears N. 38° E., distant $17\frac{1}{2}$ miles. From Eastern Grove lighthouse is shown, at a height of 93 feet above high water, a *fixed white* light visible between the bearings of N.E. by N. through north and N.W. by W., and should be seen 15 miles. A faint light is visible between N.W. by N. and N.W. by W.

SPIT LIGHT-VESSEL.—The light-vessel *Spit* is moored in a depth of 26 feet, with Elephant point obelisk N. 63° W. about 3 miles, and Eastern Grove lighthouse N. 15° E.; and exhibits, at a height of 54 feet above the sea, a *fixed white* light visible 5 miles.

ELEPHANT POINT LIGHTS.—Two lights, which in line lead over the position of Upper spit buoy, are shown from the southern part of Elephant point. The front light is a *fixed white* light, elevated 15 feet above the ground. The rear light is also a *fixed white* light, elevated 35 feet above the ground, and bears W.N.W. 200 feet from the front light.

Buoyage.—Between the sea and Rangoon, the channel is marked by red buoys on the starboard hand and black buoys on the port hand, entering from seaward.

Lekogon pagodas, on the coast north-westward of China Bakir lighthouse, stand close together, and are four in number; they are not easily recognised, being of a brown colour, and about the same height as the surrounding groves of trees.

Elephant point is distinguished by a tall needle-shaped obelisk about 130 feet high, which is a useful mark for fixing a vessel's

position in the Western channel. The square telegraph tower is the only other building on the point that is conspicuous from seaward. The point itself is very low, with a few tall palm trees near.

The clump of trees, situated $3\frac{1}{2}$ miles south-westward of Elephant point, is not easily recognised by a stranger.

A tide-gauge, which is a mast with steps, surmounted by pole and basket, stands at the edge of the low water bank, 3 miles S.S.E. from Elephant point obelisk.

Another tide-gauge has been erected just inside Elephant point, the figures on which show the height of the tide above the level to which the soundings on the chart are reduced.

Telegraph-Signal Station.—A flagstaff is situated close to the telegraph tower on Elephant point; vessels at the outer anchorage can communicate with this flagstaff by means of the International code. The station is connected with Rangoon by telegraph.

Grove point, on the eastern side of Rangoon river entrance, is easily recognised by Eastern Grove lighthouse, three-quarters of a mile eastward of the point.

Pilot tree is situated N. $\frac{1}{4}$ E. $2\frac{1}{4}$ miles from Eastern Grove lighthouse; two black baskets are fixed in the upper part of this tree, which is dead. A four-posted beacon, surmounted by a black basket has been placed close to Pilot tree, but this beacon being low is hard to recognise. A four-posted beacon, painted red, and surmounted by a black circular basket, stands at high water mark, about half a mile W. $\frac{1}{2}$ N. from Eastern Grove lighthouse. This beacon, with Pilot tree, serves as a leading mark between Eastern sands and Spit sand. The ruins of a fallen obelisk lie on the bank about 2 cables south-eastward of the beacon.

Fairway buoy, black and white in horizontal bands, is moored in 21 feet at low water, E. $\frac{5}{8}$ N., $4\frac{3}{4}$ miles from China Bakír lighthouse, and marks the entrance to the Western channel into the Rangoon river.

TIDES.—At springs, in the more confined parts of the channel into the Rangoon river, and along both coasts of the gulf of Martaban, the tides are of great strength, running from 5 to 7 knots.*

It is high water, full and change, at China Bakír lighthouse at 1h. 45m., springs rise 16 feet, neaps 11 feet; at Elephant point at 3h. 15m., springs rise 19 feet, neaps 13 feet.

* After the rains, the tides outside Rangoon river, are subject to a circular motion; the first of the flood sets east, gradually changing to N.E. at half flood, and to north in the latter part of the tide. The ebb sets in the reverse directions, beginning by running west it changes gradually to S.W. and south, ending at S.E. There is no slack water at either tide, the streams continuing to run at the rate of $1\frac{1}{2}$ or 2 knots.—Horsburgh, eighth edition, p. 674.

The rise and fall of tide given above is for the dry season or from December to March ; during the rains at springs, the rise at Elephant point sometimes amounts to 21 and 22 feet.

In the Western channel the flood sets north-east along the coast as far as West lump buoy, when it turns gradually to the northward into the river. The great body of the flood passes eastward into Sittang river ; and in the Eastern channel the flood is comparatively weak, setting to the north-west, and about half an hour later than in the Western channel.

Inside Elephant point, on the western side where the channel is confined by the Middle bank, the flood runs about 6 knots at springs, decreasing in strength as the northern part of the Middle bank is passed.

The ebb tide sets S.W. in the Western channel outside Elephant point ; and S.E. in the Eastern channel, gradually altering its direction to S.W., as it sweeps round the south-eastern edge of Eastern sand. Inside the river the tide generally takes the course of the channel, strong eddies being met with off the various points during spring tides.

The tidal stream is strongest on the night of the second day after full or new moon ; it then runs in the channels at the rate of 7 miles an hour, and there is only a few minutes slack water. After neaps the streams gradually increase in strength and continue to run strong, until the moon quarters when they suddenly take off ; on the second and third day after the moon's quartering there is slack water on the flood for $1\frac{1}{2}$ hours, and on the ebb for one hour.

The flood tide at springs makes suddenly and rises 6 feet in the first hour ; the ebb stream, however, still continues running in mid-channel and it is not slack water until one hour after the water has commenced to rise. The flood stream turns earlier in shore than in mid-channel.

In the rains, or the months of June to September, the flood tide is weaker and the ebb stronger than during the remainder of the year, vessels at times not swinging to the flood stream off the town of Rangoon.

At half flood, when the banks are covered, the stream after passing the second red buoy runs over Spit sand directly towards Elephant point. The ebb stream sets from the Spit buoy across the channel on to Long sand.

China Bakir flats extend along the western side of the mouth of Rangoon river, from the entrance of China Bakir river as far as

Spit sand, south-eastward of Elephant point. At low water these flats dry to an average distance of 2 miles from the coast.

Eastern and Long Sands, south-eastward of Elephant point, extend about 4 miles north and south, by $3\frac{1}{2}$ miles east and west. Portions of these sands dry at low-water spring tides, their highest part being then 8 feet above water.

There is a heavy sea on them during bad weather, but in moderate weather they are not distinctly marked.

Spit Sand, extending to the south-east from Elephant point, is a narrow tongue or spit which dries at low water, and off which shoal water extends into the Western channel in a south-east direction, to a distance of $2\frac{1}{2}$ miles from Elephant point obelisk.

Middle Bank, portions of which dry, at the entrance to the river between Elephant and Grove points, extends 4 miles in a W.N.W. and E.S.E. direction and is connected by shoal water with the Eastern sands.

WESTERN CHANNEL.—Buoys.—The Western channel runs between China Bakir flats and Spit sand to the westward, and Eastern sands and Middle bank to the eastward. It is marked on its western side by 7 black buoys as follows :—Lower western buoy, in 19 feet, about $3\frac{1}{10}$ miles N.N.W. from the Fairway buoy ; Centre western buoy, in 21 feet ; and Upper western buoy, in 21 to 22 feet ; mark the edge of China Bakir flats. Lower spit buoy, in 24 feet ; Centre spit buoy, in 21 feet ; West lump buoy, in 29 feet ; and Upper spit buoy, in 23 feet ; mark the edge of Spit sand up to Elephant point. This channel is marked on its eastern side by 8 red buoys as follows :—Lower eastern buoy, in 17 feet, N.E. $\frac{1}{2}$ N., $5\frac{2}{10}$ miles from the Fairway buoy, marks the south-western part of the tail of Eastern sands. Centre eastern buoy, in 20 to 21 feet ; and Upper eastern buoy, in 17 feet ; mark the western edge of Eastern sands. Lower ridge buoy, in 20 feet ; and Upper ridge buoy, in 17 feet ; mark the western side of the ridge connecting Eastern sands and Middle bank. Lower Middle bank buoy, in 23 feet ; Centre Middle bank buoy, in 18 feet ; and Upper Middle bank buoy, in 17 feet ; mark the south-western side of Middle bank.

EASTERN CHANNEL, eastward of Eastern sands and Middle bank, is not buoyed, and hitherto the pilots have been forbidden to use this channel.

Hmawwun Lump, 2 miles south of Bassoin creek, off the mouth of Hmawwun creek, has 8 feet over it at low water, and is marked by a red buoy, which lies in 16 feet about a cable S.W.

of it; the deep water channel lying on the west side. A sand flat extends off the mouth of Hmawwun creek and almost joins Hmawwun lump.

Da Silva Shoal lies about the middle of the river, the south extreme being $1\frac{1}{2}$ miles north of Bassein creek, and extends $1\frac{1}{4}$ miles north and south, has 5 feet over it at low-water springs, and is joined to the west bank, the deep water lying on the east side of the shoal. A depth of 6 to 8 feet can be carried to the westward of the sand, but the use of that channel is prohibited.

Choki Lumps, a patch lying between Choki point and Da Silva point, has 9 feet over it at low-water springs, the deepest water lying on the west side; Choki lumps are joined to Choki point by a narrow ridge, having 12 to 15 feet over it at low water springs, but the depth is subject to change.

Buoys.—Lower Choki lumps buoy is red, and moored in 19 feet near the south-east extreme of Choki lumps. Upper Choki lumps buoy is red, and moored at the south-western edge of the shoal to serve as a mark for vessels rounding into Liffey reach.

Liffey Sand extends $3\frac{3}{4}$ miles southward from King point along the west side of the river, and about half way across, the deep water channel being on the eastern side. The highest part dries 8 feet at low-water spring tides.

Hastings Shoal* lies between the north end of Liffey sand and Monkey point; its extent in a N.N.W. and S.S.E. direction is $1\frac{1}{4}$ miles, and its breadth about half a mile; it dries in places, and the depths on it are subject to much change.

Buoys.—Two black buoys mark the eastern edge of Hastings shoal. Lower Hastings shoal buoy, in 12 feet, marks the south-eastern part; Upper Hastings shoal buoy, in 14 feet, marks the north-eastern point of the shoal. A green wreck buoy marks a shoal patch near the wreck of the *Mary Anne*, about 3 cables south-westward of the Upper Hastings shoal buoy.

Syriam flat, on the eastern side of the channel north-eastward of Hastings shoal, is marked at its western extreme by a red buoy.

Alun Sand lies off the western end of the town of Rangoon, and extends from the north shore, three quarters of the distance across the river, the channel lying between the sand and the south bank of the river. The town flagstaff in line with the extreme of Mill point clears the south end of Alun sand.

* See plan of port of Rangoon on Admiralty chart, No. 833, scale, $m = 3.3$ inches.

DIRECTIONS.—A sailing vessel should not attempt to enter the river without a commanding breeze. The best water in the Western channel is about a mile eastward of the black buoys marking the west side of the channel. If the tide has risen sufficiently to afford ample water, the mid-channel course from the Fairway buoy is N.N.E. $\frac{1}{4}$ E., to midway between the Upper Western and Centre Eastern buoys. The mouth of the river will then be distinguishable by the obelisk on Elephant point on the west side, and Eastern Grove lighthouse on the east side. Course may then be altered to pass between Lower Spit and Upper Eastern buoys, by which time Pilot tree will be seen, and it should be kept a little open eastward of the beacon on Grove point, N. by E., past Centre Spit buoy on the port hand, the light-vessel on the starboard hand, and as far as midway between West Lump and Lower Ridge buoys. Then alter course to N.W. $\frac{3}{4}$ W., leaving Upper Spit buoy on the port hand, and Upper Ridge buoy on the starboard hand, and continue until Motjua white beacon on west bank, opens northward of Elephant point, W. by N. $\frac{3}{4}$ N. Then steer to round Elephant point at a distance of about 2 cables, afterwards keeping along the western bank at that distance, leaving the three Middle Bank buoys on the starboard hand, as far as Hmawwun lumps. The mark for leading westward of those shoals is Syriam pagoda in line with North white beacon (basket and umbrella), both on east bank, N. $\frac{3}{8}$ E. Leave the buoy marking Hmawwun lumps on the starboard hand, and then keep Syriam pagoda in line with North white beacon, until half a mile past South beacon (white, with basket); when haul to the eastward, and bring Syriam pagoda in line with Red mark (pole, with basket), situated a short distance south-eastward of North beacon, about N. $\frac{1}{4}$ E. This mark leads eastward of Da Silva shoal, and should be kept on until Shwe Dagon (the great pagoda northward of Rangoon) is in line with Choki point, N.W. $\frac{1}{2}$ N.; when that mark should be kept on, passing about 2 cables from the eastern bank, as far as abreast Choki village. Then cross over to pass about $1\frac{1}{2}$ cables northward of Da Silva point, and midway between the bank westward of that point and the Choki lump buoys. After rounding Upper Choki lump buoy steer to the northward, and when past Choki point keep about a quarter of a mile from the east bank until within half a mile of Syriam point. A vessel will be eastward of the north-east edge of Liffey sand, while the west bank of the river, south-westward of Da Silva point, is shut in by Choki point.

While below Syriam point the tidal semaphore at King point should be looked at, for the purpose of ascertaining the rise of tide,

before proceeding northward of Hastings shoal. For signals, *see* below.

From south-westward of Syriam point, steer north-westward, passing midway between the Upper Hastings shoal buoy and Syriam flat buoy. Then bring Mill chimney, on Mill point opposite Rangoon, nearly in line with the iron sheer legs on Rangoon town side, as the mark for crossing the shoal water northward of Hastings shoal.

When abreast Monkey point, bring the chimney more open of the sheer legs, and keep about two-thirds of a cable from the North bank until abreast Pegu sawmill chimney. A vessel should then anchor unless previously boarded by the harbour master.

Caution.—The Northern channel is very narrow, and the shipping in the port of Rangoon make the leading marks very difficult to recognise; caution is therefore necessary, as the turn round the elbow of Hastings shoal is sharp and the tide runs strong.

TIDAL signals.—On King point, south-eastward of Rangoon, there is a tidal semaphore showing the rise of the tide above low water springs, as follows :—

0	1	2	3	4	5 FEET
6	7	8	9	10	11 FEET
12	13	14	15	16	17 FEET
18	19	20	21	22	23 FEET

As seen coming from the southward.

In Rangoon reach the signals will show the reverse way.

Inner Navigation.—For remarks on the navigation of the Irrawaddy above Rangoon, *see* pages 334 to 349.

RANGOON, the chief export town in Burma, is 21 miles from sea by the course of the river. The principal part of the town and the military cantonments are on the left bank of the river ; but large timber yards and factories are built on the opposite (Dalla) shore, and the town there is fast rising in importance. The principal buildings are the public offices on the Strand, the Municipal market, and English church ; but the most conspicuous object in Rangoon is Shwe Dagon pagoda, 487 feet above high water, and gilded from base to summit : there are also several other pagodas in the town and neighbourhood, that at Syriam, 6 miles to the south-east of the town, being the next largest. The town is well laid out and clean. A large portion of the population consists of Chinese. In 1891 the total population numbered 182,000. There is good anchorage off the town for vessels of any size. The limits of the port are marked by boundary pillars.

Wharves.—Alongside Brooking wharf the depth is 24 feet at low water springs ; at Phayre street wharf, 22 feet ; at Soolay pagoda wharf, 20 feet ; at Latter street wharf, 20 feet. These wharves are under the Port Commissioners, and are connected with the railways.

Coal.—From 3,000 to 5,000 tons are kept in stock : vessels are coaled at the rate of 500 tons a day. Coaling is usually carried on by boats to vessels lying in the stream, but it could be performed alongside a wharf if necessary.

Patent slip can take up a vessel of 500 tons, but a vessel of 800 tons has been taken on the bottom of the slip. There is a grid-iron for river steamers.

Repairs.—A vessel of 1,033 tons has been built at Rangoon. Engines of 1,200 horse-power have been repaired, cylinders of 60 inches diameter can be bored, boilers of any size repaired, and shafts of 14 inches in diameter forged and turned. There is a crane capable of lifting 15 tons.

Trade.—Shipping.—The exports are rice, teak, timber, raw cotton, raw caoutchouc, cutch, raw hides, jadestone, horns, pulse, and paraffin wax. The imports are coal, salt, cotton, both twist and yarn, piece-goods, hardware, cutlery, metals, earthenware, provisions, raw silk, silk piece-goods, glassware, oils, machinery, candles, and woollen goods. The total value of exports and imports, including coasting trade, in the year 1889–90 was Rs. 155,000,000. In the year 1889–90 the port was entered by 826 vessels of 578,942 total tons.

Communication.—Rangoon is connected with the telegraphic system of India. Railways run to Mandalay (Sittang valley), nearly 400 miles northward of Rangoon; and to Prome (Irrawaddy valley), about 160 miles north-west of Rangoon. There is steam communication bi-weekly to Calcutta and Madras, and weekly to the Straits Settlements. Inland, steamers run twice a week to Mandalay, and twice a month to Bhamo, about 800 miles from the sea, and considered to be the limit of navigation by steamers.

Supplies of every description can be obtained. Water is brought alongside.

Hospital.—Sailors' Home.—There is a hospital to which seamen are admitted, also a Sailors' home, at Rangoon.

Tides.—It is high water, full and change, at the Master Attendant's wharf at 4 hrs. 45 min.; springs rise 19 feet, neaps 14 feet, during the dry season, December to April; but during the rains, the rise at springs is increased to from 21 to 24 feet. The velocity of the stream at springs is 5 to 6 knots.

STORM SIGNALS are shown from a flagstaff near the Custom house at Rangoon. For signals, *see* page 27.

Climate.—The following table is from observations taken at Rangoon at an elevation of 41 feet above sea level :—

Month.	Temperature.					Humidity.		Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Cloud.	Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.						
January - -	75	88	64	24	35	66	2·4	0·2	1	29·96	·13
February - -	77	93	65	28	38	62	2·2	0·1	1	—·91	·14
March - -	81	97	71	26	37	64	2·2	0·1	...	—·87	·15
April - - -	84	98	76	22	31	68	3·6	1·8	4	—·80	·15
May - - -	83	93	77	16	27	76	6·5	10·9	16	—·75	·12
June - - -	79	86	77	9	18	88	8·8	18·4	28	—·73	·09
July - - -	78	85	76	9	16	90	9·0	21·3	29	—·73	·08
August - -	78	85	76	9	16	91	9·0	18·6	27	—·75	·09
September -	78	85	76	9	16	89	8·3	16·0	26	—·79	·11
October - -	80	88	76	12	18	85	6·2	8·1	14	—·84	·12
November -	78	87	73	14	24	80	4·5	3·4	6	—·89	·11
December -	76	87	68	19	29	74	3·2	0·1	1	—·94	·12

PEGU RIVER, which flows into Rangoon river just below the town of Rangoon, rises in the southern slopes of the Pegu Romas, and after a S.S.E. course of about 50 miles to Pegu, where it is 105 yards broad, and is spanned by a bridge, it trends south for about 15 miles, and then S.W. by S. for 35 miles to Rangoon. At Pegu, in the dry season, the river is almost dry at low tides, and the rise with the flood is from 4 to 5 feet. On the east it communicates with the Sittang by several channels, that of Paing kiwon forming a canal between the two rivers. A new canal, leaving the Paing kiwon some distance east of Kyaik padaing, and striking the Sittang at Myitkyo, is being constructed. A bore with a crest about three feet high sweeps up the Pegu river, especially in the months of February, March, and April, and its effects are felt at Pegu in the sudden rising of the early flood. During the rains steam navigation is carried on in connexion with Toungoo (Taungú).

Pazundaung Creek also rises in the southern slopes of the Pegu Romas, and after a S. by E. course of about 53 miles, joins the Rangoon river just below the town of Rangoon, where its mouth is about 440 yards in width. Thirty-five miles above Rangoon it is 50 feet broad, and flows between high steep banks, the river having a depth of 3 feet during the dry season, and a tidal rise of $1\frac{1}{2}$ feet. Towards its mouth, the banks are steep and muddy. Boats ascend for about 40 miles.

INNER NAVIGATION.—The river Irrawaddy is full of islands and sandbanks, many of which are submerged during the rains, and the eastern bank then suffers from inundations. The river is navigable at all seasons by steamers drawing 4 feet, as high as Bhamo, or some 800 miles from the sea; and during the dry season for steamers drawing 6 feet as far as Thayetmyo. *See* page 339. In the rains, steamers and large boats enter the main stream of the Irrawaddy from Rangoon by the Panhlaing or Bawle creeks; but during the dry season they have to descend the Rangoon river for some distance, and, passing through the Bassein creek, enter the Irrawaddy through the inner part of the To or China Bakir river.*

From Mandalay in lat. 22° N. to the junction with the China Bakir river in lat. 17° N. the general width of the Irrawaddy varies from 500 to 3,000 yards. The banks are in general wooded and well defined. No rules can be laid down for the best channels, as changes frequently take place, but the pilots are intelligent and trustworthy. Two miles below Akauktaung on the right bank of the river, is a remarkable

* *See* Admiralty charts :—Bay of Bengal, east coast, Koronge island to White point, No. 823; and Irrawaddy river, sheets I. and II., Nos. 2,135 and 2,136.

cliff, covered with images of Buddha carved out of the rock. It is about three quarters of a mile in length and rises 400 feet sheer out of the river. This is the first high land met with when ascending the river. Here the current runs with great strength, as much as $7\frac{1}{2}$ knots having been experienced in August.*

In July 1881, H.M.S. *Ready*, drawing 10 ft. 2 in. water, ascended the river from Rangoon to Thayetmyo. The track pursued was that leading through Panhlaing creek, which joins the main river at Yandún, about 60 miles above Rangoon. When descending the river, Rangoon was reached through the To or China Bakir river and Bassein creek. The navigation of the main stream in the month of July was found easy, and there was sufficient water in it for a vessel drawing 15 feet.

Routes.—To reach the main river from Rangoon, the route by Panhlaing creek is recommended when ascending the river, as it is 67 miles shorter than the Bassein creek route, and carries 6 feet more water; the creek is, however, narrow and intricate, and at the point of junction with the main stream the navigation is so difficult that none but steam vessels fitted either with twin-screws or large additional rudders could turn. Panhlaing creek is not used by steam vessels when descending the river on account of the difficulties and frequent accidents incidental to this point.

The route by China Bakir river and Bassein creek is that used by large steam vessels on their downward trip, being much less obstructed than Panhlaing creek, and having almost always a sufficient depth of water for vessels drawing not more than 6 feet, at high water neaps. A vessel drawing more than 6 feet can only be certain of getting through Bassein creek at spring tides.†

The *Ready* drawing 9 ft. 9 in. passed through Bassein creek on the flood one day before spring tides; for a distance of several miles there was not more than her own draught of water, but the mud was so soft that the vessel never brought up, though steaming as slowly as possible, through the shallower parts. It is said that by carefully judging the time of entering this creek a depth of 12 feet may be

* Remark book of Commander W. R. Clutterbuck, H.M.S. *Woodlark*, 1885.

† It is high water 50 minutes earlier at the west end of Bassein creek, than at the eastern entrance. During the last quarter of the flood and first hour of the ebb, the stream runs to the westward throughout the creek. After that, however, the streams separate and flow out of both ends. (Remarks by officers of H.M.S. *Woodlark*, 1885.)

depended upon, but the difficulty of so judging renders vessels of more than 10 feet draught liable to be detained.*

H.M.S. *Woodlark*, however, which vessel passed through Bassein creek on the 11th August 1885, one day after new moon, found the least depth of water to be 16 feet (near its south-west end). The *Woodlark* entered from the Rangoon river, $2\frac{1}{4}$ hours before high water at Elephant point and her speed was estimated at $7\frac{1}{2}$ knots per hour. After entering the China Bakir river, a depth of not less than 4 fathoms was found near the left bank as far as Dayage. The strength of the current was ascertained to be $3\frac{1}{4}$ knots, and the least depth of water found between Dayage and the junction with the main river, was 25 feet.

There are two other routes from seaward up the Irrawaddy river, namely, that leading through Bassein river and Thamadine creek, and that through the entrance to the Irrawaddy proper, which enters the sea at a few miles west of Krishna shoal. Of these routes, Thamadine creek which is always used by the river steam vessels, is narrow and intricate, but has a depth of 3 fathoms; it joins the main stream at a little below Henzada, about 120 miles above Rangoon. The Irrawaddy proper is said to be the straightest and best channel to the sea, having a depth of 12 feet on the bar at low-water springs.

Up-River Pilots.†—The *Ready*, both up and down, was accompanied and generally preceded by the India Government steam vessel *Irrawaddy*; pilots belonging to the Irrawaddy Flotilla Company were employed in both vessels, and found trustworthy; the frequent fluctuations of the river can only be followed by the constant observation of local pilots, who are each qualified for districts about 60 miles long. The pilots are mostly Chittagongese.

Current.—The average current experienced when above tidal influence was 3 knots an hour, but at some points it attained a velocity of between 5 and 6 knots.

Rise of River.—The tide is felt as far up as Henzada, about 120 miles above the town of Rangoon. In March the river commences

* The Irrawaddy Flotilla Company's steamers, which use the Bassein creek in their voyages to and from Rangoon town, anchor near the Fort, just inside the Bassein creek, which is about half a mile broad there. The creek dries in many places at low water, but by entering at the proper time of tide, a vessel drawing 8 feet can get through without stopping, as the tide appears to separate about half way through, so that if a vessel entered with the flood at either end, and proceeded as the water rose over the shoal parts, maintaining a moderate speed of 5 or 6 knots, she would leave the other end with first of the ebb.—Lieut. E. C. H. Helby, R.N., 1884.

† Masters of Irrawaddy Flotilla Company pilot their vessels as far as Donabyu; thence to Bhamo, the local pilots are employed.

to rise, steadily increasing in June, and attaining its maximum height in September, at which time it is, at Prome, about 34 feet above its dry season level. The *Ready* reached Thayetmyo after the first rise of the river, which at the time of her arrival (7th July) was 7 feet below the mean high level. During a stay of 13 days it fell from 7 to 8 feet, but commenced to rise again on 20th July. In 1877 the river is reported to have risen 9 feet above the mean high level, that being the highest rise recorded. The rise varies, being sometimes greater at Prome than at Thayetmyo, 50 miles above; but generally it decreases below Prome and increases above that place.

At Thayetmyo the river is about 3 miles broad and the bank, as a rule, so steep that vessels can lie sufficiently near to admit of hauling a boat to and fro by a line; care, however, should be taken lest the copper be rubbed by snags, projecting from the bank at a few feet below the water.

Up-River Trade.—The Irrawaddy Flotilla Company with head-quarters at Rangoon, owning about sixty vessels, maintain the great bulk of the trade, which is estimated roughly at about one and a half millions sterling, either way. The following are the stopping stations between Rangoon and Mandalay. Up stream, Yandún, Donabyu, Henzada, Yeiking, Myanaung, Prome, Thayetmyo (military station), Minhla, Magwe, Yananyaung, Sinbugyan, Nyaungu, Kuniwa, Pokoku, and Mandalay, about 350 miles above Prome.

The chief articles carried up stream are piece-goods, rice, salts, hardware, and silk. The down stream cargo consists of raw cotton, cutch (for dyeing), india-rubber, jade, spices, precious stones, timber, earth-oil, and cereals. The steamers stop on the downward voyage at Letsambu and Tsagine, in addition to the up-stream stopping stations.

TO or CHINA BAKÍR RIVER enters the sea through extensive flats of sand and mud, about 4 miles to the southward of China Bakír Lighthouse.

The coast is well wooded, but the entrance to the river may be made out from aloft by the long compact clump of dark trees on its eastern side, the western end of which appears very abrupt, as seen from seaward when abreast the entrance. To the eastward of this clump the trees are much less compact and occasional large gaps appear. About half a mile inside the eastern point of the entrance is a small fishing village, To ah, and about the same distance from

the village is Mengalon creek, by which boats can proceed to the town of Mengalon, about a mile inland.

The western side of the entrance is also wooded, but not so closely as the eastern, and there is a small clump of cocoanut trees near it, which may be useful for identification. Both banks are lined with mangroves, and about $2\frac{1}{2}$ miles from the eastern entrance point, or about 8 miles from the 3 fathoms line outside the shoals, the river forks—one branch, the Bassein creek, leading in a north-easterly direction into the Rangoon river, about 10 miles below Rangoon town. The other branch, which just inside the fork is partially blocked by an island and shoal water, leads in a north-westerly direction.

DIRECTIONS.—The channel through the sand banks which obstruct the entrance to the China Bakír river is very narrow at its outer end, and although a vessel of 15 feet draught can enter by careful navigation at high-water spring tides—it should not be attempted without having previously carefully marked the channel, and until that is accomplished she should remain at anchor in about 18 feet at low-water springs, with China Bakír Lighthouse bearing N.E. $\frac{1}{4}$ N. distant 5 miles; from this position which is $2\frac{1}{2}$ miles from the narrows, and about one mile from the 2 fathoms line, the village of To ah should be seen just open west of the west extreme of the long compact clump, N. 19° W., on the eastern point of the river entrance; and this is a good general guide for finding the passage through the shoals, for the purpose of buoying or staking it, but no vessel should attempt to enter until the channel has been artificially marked.

After passing the narrows, the depth of water rapidly increases and a N.N.W. $\frac{3}{4}$ W. course, keeping on the eastern side of the river, will lead to the Fork.

If proceeding to the north-westward, the deep water channel is on the northern side of the island at the fork, and a vessel after passing close to the point, at which the coast trends away to the north-eastward into the Bassein creek, should steer across the mouth of the Bassein creek, keeping slightly to the eastward until the centre of the channel is open, when she may enter, avoiding the extensive mud bank which extends off the south-east end of the island, by keeping nearer to the northern shore. There is a small bank also off the northern point of the channel entrance, but of no great extent, and steep-to.

The following information, which is of interest, has been taken from the Rangoon pocket almanac 1884, and it is presumed that the distances quoted are only approximately correct.

ROUTES BY RIVER.

ROUTE No. 1, FROM RANGOON TO THAYETMYO.

DRY SEASON FROM ABOUT 15TH OCT. TO 15TH JUNE.

From Rangoon to entrance of Bassein creek, 15 miles.

From entrance of Bassein to China Bakir river, 27 miles.

From China Bakir to Thonkwa, 46 miles, R. B.* Large village. Native supplies available.

From Thonkwa to Ma u bin, 7 miles, R. B. Fair-sized village. Native supplies available in limited quantities.

From Ma u bin to Donabyu, 44 miles, R. B. Large village. Native supplies available.

From Donabyu to Zalun, 28 miles, R. B. Native supplies available.

From Zalun to Henzada, 19 miles, R. B. Large town. Supplies for both European and Native troops available.

From Henzada to Yei king or Yegain mengyi, 60 miles, R. B. Native supplies available.

From Yegain mengyi to Myanaung, 14 miles, R. B. Native supplies available.

From Myanaung to Prome, 60 miles, L. B.† Large town. Supplies for both European and Native troops available.

From Prome to Thayetmyo, 44 miles, R. B. Large town. Supplies for both European and Native troops available. Frontier station.

Total distance from Rangoon to Thayetmyo, 364 miles.

NOTE.—Time taken in above passage in river steamers with two heavy flats, from 6 to 9 days. On emergency and with moonlight nights the trip could be done in from 4 to 5 days. The down passage from Thayetmyo to Rangoon follows the same route as the above, but the trip can be made in 3 days.

ROUTE No. 2, FROM RANGOON TO THAYETMYO.

Monsoon route from about 15th June to 15th October.

From Rangoon to Mayzali creek, 23 miles, viâ Hline or Rangoon river.

* R. B. denotes Right bank of river.

† L. B. denotes Left bank of river.

From Mayzali creek to Panhlaing creek, Kattywa, 13 miles, R. B. Fair-sized village. Native supplies available.

From Panhlaing creek, Kattywa to Irrawaddy river, Nyaundung 24 miles, L. B. Large village. Native supplies and European supplies available in limited quantities.

From Irrawaddy river Nyaundung to Donabyu, 15 miles, R. B. *See remarks in Route No. 1.*

From Donabyu to Zalun, 28 miles, R. B. *See remarks in Route No. 1.*

From Zalun to Henzada, 19 miles, R. B. *See remarks in Route No. 1.*

From Henzada to Yegain mengyi, 60 miles, R. B. *See remarks in Route No. 1.*

From Yegain mengyi to Myanaung, 14 miles, R. B. *See remarks in Route No. 1.*

From Myanaung to Prome, 60 miles, L. B. *See remarks in Route No. 1.*

From Prome to Thayetmyo, 44 miles, R. B. *See remarks in Route No. 1.*

Total distance from Rangoon to Thayetmyo, 305 miles.

NOTE.—Time taken in above passage in river steamers with two heavy flats, from 5 to 8 days. On emergency and with favourable weather and moonlight nights, the passage could be done in about 4 days.

In the down passage from Thayetmyo to Rangoon the China Bakir route is adopted.

UPPER IRRAWADDY RIVER.*

Tributaries.—The principal affluents of the Irrawaddy river are the Mogaung, Taeping, Shewelé, or Swali, Maina, Karin, Madra, Myitnge, Mu, Chindwin, Yan and Yen rivers; of these the Chindwin is by far the largest, and although not as deep as the Irrawaddy, drains a large area of country, and on meeting the main stream in about lat. $21^{\circ} 45' N.$, doubles its volume.

There are three defiles through which the Irrawaddy river flows. The northern, above Bhamo town is only navigable by boats in the dry season.

* Compiled from remarks by Commander A. Carpenter, R.N., in charge of Indian Marine Survey, 1886.

The second defile, 15 miles to the southward of Bhamo and very picturesque, is 8 miles long and about 160 yards wide at its narrowest part, the greatest depth being 23 fathoms ; hills about 900 feet high rise almost perpendicularly on either hand.

The third defile, 35 miles above Mandalay, through which the river flows quietly between two ranges of mountains trending north and south, is 29 miles long, with an average depth of 4 fathoms and a quarter of a mile wide at its narrowest part.

From Thayetmyo to Minhla, lat. $19^{\circ} 20' N.$ to $20^{\circ} 0' N.$, a distance by river of about 46 miles, the river runs nearly due north for the first 25 miles (skirting the eastern face of a range of hills 1,200 feet high), when it is divided into two channels by Laungi island, wooded, $1\frac{1}{2}$ miles in length, with a sand bank projecting from its northern and north-western sides ; the channel, narrow but deep, lies along the western or right bank ; care is necessary on account of the eddies that form off two small hillocks opposite the west point of Laungi island. The eastern channel which leads past the town of Senbaungwai can only be used in the wet season. There is no town of importance in this reach, Mye de 3 miles above Thayetmyo being deserted.

From Laungi island to Minhla the river bends considerably but there are no middle grounds and the course though crooked is an easy one, the river flowing between hills from 100 to 300 feet high, half way between Laungi island and Minhla.

Taung gwen island, $1\frac{1}{2}$ miles long, with some ancient pagodas on it, lies in the centre of the river, the course is up the western channel.

Minhla is situated at an angle of the river on the western bank. Kola kone fort occupies the heights opposite the town. There is good anchorage where the river opens out between Kola kone fort and the town, except to the S.E. of the point on which the town is built, where a sand bank exists. Vessels secure if required, alongside the river bank close to a small square fort in the centre of the town ; trade is considerable and is probably brought down the Yen river. The current runs strong off Minhla.

Yanan yaung lies about 25 miles above Minhla. Two miles above the latter, the river opens out considerably and central low lying islets and sand banks make the channel intricate.

The Yen river joins the Irrawaddy on the left or eastern bank, 7 miles above Minhla, having off its mouth a large low island

surrounded by sand banks, on the southern side of which, lies the channel.

Magwe, 15 miles above Minhla, on the eastern bank, is about 3 miles long, with several fine pagodas; Menbo town opposite is also rendered conspicuous by its pagodas and high cliffs. In the dry season the deep channel crosses the river eight times or at every 4 miles. The hills lie well back in this reach except at Magwe and Ta fau zeik, an abrupt rocky point with cliffs 80 to 120 feet high and a pagoda on their summit; the channel passes close to this point, a sand bank extending towards Ta fau zeik point from the opposite bank, narrowing the channel considerably.

From Minhla to Yanan yaung, the river trends about N. by W., and receives five tributaries, viz., on the eastern bank the Yen, the Karin 10 miles below, and the Pyin one mile above Yanan yaung; and on the western bank, the Ma river immediately above Menbo and a smaller stream opposite Yanan yaung. The current is stronger in this reach than in any other above Thayetmyo.

The low central islands and the flats on either bank are covered with elephant grass 8 to 10 feet high; most of these islands cover in August, the grass only showing above the water. Temporary villages are built on piles and the islands cultivated during the dry season.

From Yanan yaung to Pagan, a distance of 42 miles in the wet and 50 in the dry season, the river trends N.N.W. and North. The most important places in this reach are Kyabin near Semfyogun on the west bank, and Pagan nge and Silli myo on the eastern bank, Pagan nge lies opposite and below Kyabin. The channel crosses the river about every 6 miles, and the breadth between the main banks averages 2 miles; the greatest width of river is between Pagan nge and Silli myo, nearly 4 miles between the main banks. The bed of the river is filled with extensive flat islands that nearly cover in the freshets, and in the dry season the channel lies between the two large alluvial islands, the main banks only being recognised by the line of large trees showing on either hand; about 10 miles above Yanan yaung and again above Palaimyo, low hills run close down to the river bank.

About 6 to 10 miles east of Silli myo a solitary mountain named Poupa, rises abruptly, and is visible from Magwe up to Mingyin. Some of the bends of the channel in this reach are very sharp, turning almost straight across the river; it is advisable to keep the up stream side of the channel.

The Yan river entering this reach 13 miles below Pagan on the western bank, is the only one of importance. It disembogues through a range of hills faced with abrupt cliffs, but in the dry season the entrance is barred by sand banks. Six miles below Pagan the crossings are very crooked.

From Pagan to Mingyin, a distance of 30 miles in the wet and 40 in the dry season, the general trend of the river is about N.E. by E. and it seldom exceeds 3 miles in width between the main banks, which are low ; a small range of hills lying 3 miles back from the bank south of Pagan, trends to the southward for 7 miles. Two conspicuous hills lie about 7 miles S.S.E. of Mingyin and are in line with each other when a vessel is 2 miles to the westward of the town.

Pagan city, situated in an angle of the river in about lat. $21^{\circ} 10'$ N. long. $94^{\circ} 50'$ E., is a dead city of pagodas, and is said to have been a former capital of Burma, deserted on account of the death of a queen. Both here and at Yanan yaung the soil is very remarkable, showing a process of fossilization, the fields and river banks being covered with specimens of fossilized trees, &c.

Chindwin river, the largest tributary of the Irrawaddy, drains the country 90 miles to the westward of the right bank of that river, joining the main river 10 miles below Mingyin, some 6 miles above which town the Irrawaddy is connected with the Chindwin river by two shallow channels navigable only by boats.

Nyaungu, immediately above Pagan and on the same side of the river, is recognised by its cliffs which rise abruptly from the river side to a height of about 100 feet and are pierced with holes ; this place is a calling station for the Irrawaddy Flotilla Co.'s steamers.

Kuniwa and Pa ko ko, the only villages of any size in this reach, lie on the right or western bank of the river. In the wet season steamers call at Pa ko ko using the channel northward of the island opposite the village. In the dry season the channel lies to the southward of the island and continues along the southern bank. This bank a little above Kuniwa, has a rocky foreshore with off-lying rocks which make it very dangerous ; the rocks are buoyed, and a European is kept by the Irrawaddy Flotilla Co. who is responsible for the buoyage. The course after these dangers are passed is an ordinary one with two sharp turns before reaching Mingyin, 4 miles below which town is a 6 foot crossing.

Mingyin to Mandalay, a distance of 60 miles in the wet and 65 in the dry season. General trend of river N. by E. for 22 miles towards Myinmu, then East 21 miles to Ava and from Ava N.N.E. 10 miles to Mandalay. The river for the first 15 miles of this reach is narrow, and the banks hard and strong, except the flat ground off the north end of Mingyin town : it is clear of shoals.

Samaitkyon is a pilot station on the eastern bank, a distance of 15 miles from Mingyin ; above the village the river widens and the banks become low, the deep channel ultimately following either bank for about 3 miles at a stretch.

Nazum is a pilot station about 24 miles above Samaitkyon on the north bank, near the entrance of the Mu river, the mouth of which is dry in the month of January.

Ava, a picturesque former capital of Burma, is situated in an angle where the river turns from east to north in the direction of Mandalay. The town of Ava lies on the left or south bank, and from the walls which rise up from the river bank, a rocky shoal stretches more than half way across the river towards Sagain.

Sagain, a pretty district of pagodas and temples, lying on the opposite bank to Ava town, has a large sandflat, projecting from the river bank, which slopes off towards the east where vessels can go alongside the bank. A low range of hills, running north and south and visible from Myin mu, terminates half a mile above Sagain point ; large iron smelting works lie close to the south extremity of the hills. A large pagoda (Kaongniudhau)* with a nipple shaped dome (conspicuous from the river) stands on the plain north-west of Sagain pagodas.

Vessels and barges filled with stones, were sunk opposite Ava, to prevent the British advance in 1885, but there is still a channel close to the sandflat off Sagain and another close to the Ava shore. It is probable that this dangerous portion of the river will shortly be improved and buoyed.

From Ava to Mandalay the channel runs between low lying islets, and is intricate. The Myitnge river, which enters the Irrawaddy at the N.E. salient of the walls of Ava, is navigable for boats drawing 6 feet for over 5 miles ; in the month of January, the bar at the mouth of the river had only 5 feet over it.

* Meaning a good act.

Mandalay* is the capital of upper Burma. The town, about $1\frac{1}{2}$ miles from the river bank, is a square mile in extent, enclosed by a high thick brick wall and surrounded by a broad moat. There are four gates with bridges across this moat, facing the North, South, East, and West respectively. The palace lies nearly in the centre of the town, and is surrounded by a stockade of heavy timbers 15 to 20 feet high. Suburbs, of which the streets lie either north and south or east and west, broad but not metalled, extend to the river bank; the houses are mere native huts, with the exception of a few European dwellings, and monasteries. A large number of handsome temples stand both in the town and suburbs, some of which are gilt from roof to floor. A high embankment about a mile in length, protects the suburbs when the river is in flood.†

Amerapura, the ancient capital, prior to its being changed to Mandalay, lies about 4 miles to the southward on the left bank; it is principally interesting on account of its numerous pagodas and an old gun of large dimensions.

Mandalay to Kubwet,‡ a distance of about 50 miles in the wet and 56 in the dry season; general trend of river about north.

The first 38 miles, up to Ngasengu, the only village of any size with the exception of Shamagar, is shallow and irregular, the right bank being straight with low hills nearly to the water's edge, and the left bank having flat islets projecting from it, behind which are numerous creeks and marshes.

In the wet season the right bank is usually followed, up to the entrance of the 3rd defile which commences near Ngasengu.

The Madra discharges itself into this reach on the left bank 16 miles north of Mandalay, and forms a bar which carries on it only $6\frac{1}{2}$ feet in the dry season.

A long stretch of shallow water occurs 8 miles further north (known as the Henjazi bar), commencing a little above Shamagar; the crossings often carry as little as 4 feet, and in the driest time of the year cargo and passengers have sometimes to be transhipped by boats: there is another channel to the westward used in the wet

* Since the occupation of Mandalay by the British in December 1885, the town has altered considerably, new pukka houses having been built and streets made.

† In August 1886, the embankment gave way, the suburbs were flooded, and there was great loss of life.

‡ Or Thabyett. At Mingyin, 4 miles above Mandalay, on the right bank is a monster bell supposed to be the second largest in the world. There is also the ruins of the largest pagoda ever contemplated in Burma; this gigantic structure was rent from top to bottom by an earthquake before it was finished.

season, known as the Ywathagi channel, from reports there is better water in it, but rocks are said to be numerous, and in the dry season it is not used.

Two or three miles above Ngasengu, hills covered with tall trees and thick bamboo undergrowth commence, and form the 3rd defile. In this defile the banks are steep and sometimes stony, while the centre is deep and clear.

Kubwet is a pilot station, and lies nearly in the middle of the 3rd defile on the right bank, about half a mile to the westward of where the river takes a sharp trend to the northward in about lat. $22^{\circ} 44' N.$, long. $95^{\circ} 57' E.$

Kubwet to Mya daung, a distance of 70 miles. General direction north, the river after taking a trend due north to the eastward of Kubwet, continues through the third or lower defile for about 9 miles, to Sabainago, a large village on its right bank, here it widens out to nearly a mile between the main banks and resumes its deltaic character; hills from 400 to 500 feet run down close to the water's edge in this reach on the right bank. The left bank is flat, though there is a range of mountains 4,000 to 6,000 feet high lying back about 6 miles and following the trend of the river to about 20 miles to the southward of Mya daung. The channel is intricate, and there are two sharp crossings, one about 3 miles to the northward of Sabainago and the other about 12 miles further north.

Mya daung, a large village, is a calling port and pilot station for the Irrawaddy flotilla.

Mya daung to Modah, a distance of 45 miles. General trend N. by E. and N.E. by N. About 14 miles above Mya daung, on the left bank, a large river called the Swali or Shewelé meets the Irrawaddy. The character of this reach is similar to the one below it.

From Modah to 6 miles S.W. of it, the main banks are from $2\frac{1}{2}$ to $2\frac{1}{2}$ miles apart: the islands that have formed in the bed of the river narrow the channel to about a quarter of a mile in width, the channel lying alternately along each bank.

Modah is a pilot and calling station.

Katha, on the right bank, is the only other village of importance in this reach; it contains many priests' houses and a few Chinese traders and Shans are met with; steamers call here, wood fuel is procurable at short notice; a lake lies at the back of the village.

Modah to Bhamo, a distance of about 53 miles. From Modah the river trends a little to the northward of east for 10 miles then to the southward past Shwékugi through the pass of the 2nd defile, where it again bends in a northerly direction and then flows in an easterly one for 10 miles, when it turns to the northward towards Bhamo.

The second defile begins a little above Shwékugi, off which lies a large low island. About 4 miles from the above place is the pass, composed of a range of mountains from 800 to 2,000 feet high, through which the river flows, making a sharp bend through one of the valleys; the greatest depth found was 23 fathoms. In the freshets the eddies are so violent that it is with great difficulty steamers get through the pass, but in the dry season it is a quiet stream. The scenery is very fine, at one place the cliff rising perpendicularly 600 feet from the water. The entire length of the defile is 6 miles.

The character of this reach with the exception of the defile is the same as the others; the river is narrower, and navigable to within $1\frac{1}{2}$ miles of Bhamo. The only place where there is any trade, is at Sinkah, built at the mouth of a small creek, down which the Maung-mahtaw timber rafts come to Shwékugi and Kongti, both small villages; their inhabitants being Shans and a few Chinese.

Bhamo, a small town enclosed by a stockade, was the frontier station of the Burmans. Large caravans from Yunan arrive yearly with silks, skins, rubies, &c. Bhamo was captured by the Karins in 1885 and held for 3 months.

A range of mountains similar to those near Mandalay lies some 10 or 15 miles to the eastward of the town, the plains coming close up to their bases. These hills are peopled by the Kachens, a small but vigorous tribe.

The chief exports from Bhamo are furs, rubies, raw silk, &c. The principal imports are salt and cotton goods.

GENERAL RULES FOR MAKING PASSAGES AND FINDING THE CHANNELS.

The main banks of the Irrawaddy, generally distinguishable by high trees, pagodas, &c., are as a rule stationary, but the shapes of the flat alluvial islands and banks facing them, are constantly being altered by the current. The channel rarely keeps to the same bank for more than 3 miles, a small projection from the bank being

sufficient to deflect the water towards the opposite side ; obstructions under water often exist, and cause the crossing to assume an S shape ; this is the most difficult form of crossing, for which no guide can be given.

Great experience is requisite in the navigation of the river.

The cutting away of the banks is one of the best guides for ascertaining the channel, for as the full force of the water impinges on the bank, it crumbles away and falls in ; the point of greatest cutting is often indicated by flocks of crows and gulls, feeding upon the insects thus exposed, whilst, floating off into mid-channel, are drift and earthy bubbles. The latter exist over any depth according to their size, from 2 feet diameter over 3 to 5 feet water, up to 8 feet over a depth of from 2 to 3 fathoms. As a rule the deep water shows the fastest surface stream ; the pilots, coming down the river, watch the play of light on the water to detect the curves that the rapid moving is taking, through the dead water of the shallows.

A vessel should keep to the up stream sides of the crossings, so that in case of grounding, she may swing off into deeper water.

Climate.—The cold season begins about the middle of November at Thayetmyo, the mornings and evenings being cool, the former sometimes foggy. From November to the middle of February the weather is fine and pleasant, especially between Mandalay and Bhamo. The nights are cold, and a strong breeze sets in about 1 A.M., that should be guarded against ; often, as the wind drops, a thick fog comes on that lasts up to 10 to 11 A.M. The rainfall at Bhamo is reported to be heavy, and moderate at Mandalay, the lowest temperature observed on the 1st January at Bhamo was 52°, it has been known to fall there to 45°.

River levels.—The following observations were taken for the difference of the river level in the wet and dry season at

Donabyu	-	-	on the 18th January	-	24 feet.
Henzada	-	-	„ 17th „	-	30 „
Thayetmyo	-	-	„ 16th „	-	35 „
Yananyaung	-	-	„ 14th December	-	17 „

Estimated fall of the river at

Pagan	-	-	on the 22nd November	-	14 „
Mandalay	-	-	„ 10th January	-	12 „
20 miles above Mandalay	„	„	4th December	-	8 „
In third defile	-	„	4th „	-	10 „
„ second „	-	„	28th „	-	9 „

The river fell 8 feet at Pagan between the 24th November and 13th January; 6 feet at Thayetmyo between 2nd and 12th November. It is reported to fall a foot daily at the end of October.

Pilot stations.—The following are the pilot stations between Thayetmyo and Bhamo,—Minhla, Magwe, Yananyaung (Nyungla), Sembyajun, Sillimyo, Nyaungu (Pagan), Kuniwa, Mingyin, Samaitkyon, Nazum, Mandalay, Kubwet or Thabyett, Myadaung, Modah, Bhamo.

SITTANG RIVER.—The coast eastward of the entrance to the Rangoon river is low, and bordered by an extensive shallow bank of mud and sand, which prevents its being approached in a large vessel. Sittang river at the head of the gulf of Martaban, has a wide bell-shaped mouth, and as there are no charts of its channels, it is only entered by local trading craft. The Sittang rises in the hills of Upper Burma, about 130 miles above Taungu (Toungoo). Above the town of Sittang (Tsittaung), from which the river derives its name, the current is so strong that this part of the river is scarcely navigable by the large native boats. During the rains communication with Moulmein (by boat) is kept up through the Wengbadaw creek, the entrance to which is about 7 miles below Sittang town. By the inhabitants of the villages on either bank, Sittang river is sometimes called the Paunglaung and sometimes the Taungu river. On the eastern side of the entrance to Sittang river, are the Zingyaik mountains about 9 miles inland from the coast; these extend in a north-east and south-west direction, and have several pagodas on their summits, the northern of which is the highest. The Zingyaik mountains are sometimes visible for a distance of upwards of 50 miles, but are of little aid to navigation, being too far inland.

A bore or tidal wave sweeps up Sittang river at spring tides; following its crest, and said to be as dangerous as the bore itself, is a heavy chopping sea of sand and water. The Sittang has an enormous quantity of silt suspended in its water.

TIDES.—On the coast of Pegu the tides run strong. Westward of the Baragua flats the flood sets East and E. by N., and the ebb in the contrary direction. From the Baragua flats to Rangoon river entrance, the flood sets N.E. and N.E. by N. and the ebb to the south-west. Between Rangoon river and the coast of Martaban the flood runs strongly N.N.E. and N. by E. into the Sittang, and the ebb with equal strength out of it. During and immediately after the south-west monsoon, the ebb tides are much stronger and run longer than

the flood tides. Abreast the Baragua flats and farther westward the velocity of the tide (especially the flood) is not so great as farther to the eastward.

In the north-east part of the gulf of Martaban, between China Bakir lighthouse and Kalegawk island, the tidal streams were found, during the survey by the *Investigator* in 1887, to set to and from Sittang river, and there was no circular set. At springs the streams slacked for about half an hour at the times of high and low water at Amherst, entrance to Moulmein river. The observed maximum speed of both streams was $3\frac{1}{4}$ knots an hour, but that rate is probably exceeded during the wet season.

BALUGYUN (Bheloo Gywon).—The coast on east side of entrance to the Sittang is low, and trends S.S.E. to the entrance of the Martaban river or northern mouth of the Salween, between which and the Moulmein river, or southern mouth, lies the island of Balugyun, 17 miles in length north and south, by 8 miles in width. A range of wooded hills with pagodas on some of the peaks extends north and south throughout the centre of the island. The north and south ends of Balugyun island are higher than the centre, and have upon them thick clusters of trees. A pagoda surmounts the southern hill immediately over the south point of the island, and is a good mark in approaching Moulmein from the westward.

The western coast of Balugyun island should be given a wide berth when approaching from the northward, to avoid the shallow ground extending from it.

MOULMEIN or SALWEEN RIVER (Than lweng), the source of which is said to be amongst the mountains eastward of Assam in about lat. 28° N. After traversing Yunnan, and the Shan and Kareng ni states to the south of that province of China, it enters British territory and for some distance, as far as the mouth of the Thaung yeng (one of its tributaries), forms the eastern boundary of Burma. In this part of its course it is a broad stream flowing swiftly between high densely wooded mountains, and navigable by boats. Near the Thaung yeng, the stream is in some places not more than 30 yards wide.

Ten miles below the mouth of the Thaung yeng are the great rapids, formed by a bridge of rocks which extend completely across the river. These rapids in the dry season are impassable, even by canoes. Ten miles below are other less formidable rapids, but impassable in the rains. Below these lower rapids the river is encumbered by numerous islands and shoals, which are covered in

the rains, when the water rises about 30 feet. A few miles further south it receives the waters of the Rwonzaleng from the westward, and hereabouts the hills on the eastern bank recede, those on the western diminish considerably in altitude, and the river traverses a more open and level country. Limestone rocks, rising suddenly out of the plain into serrated lofty ridges, appear on both banks at intervals.

At Moulmein the river receives from the eastward the Gyaing, formed by the junction of the Hlaing bhwai and the Haung tharaw, and the Ataran which joins the Gyaing at its mouth. It here splits and enters the sea by two outlets, the northern of which (in lat. $16^{\circ} 27' N.$, long. $97^{\circ} 25' E.$) is known as Martaban or Darebauk river. This outlet was formerly the principal entrance, but it is now filled with small islets and sand banks. On its right bank, and opposite the town of Moulmein, is the town of Martaban, from which this mouth of the river, as well as the gulf, takes its name.*

Depth in Fairway.—Vessels of about 25 feet draught can navigate the channel from sea to Moulmein at high water springs, and of about 19 feet draught at high water neaps.

The deepest draught vessel that has visited the port was of 24 feet draught inwards, and 25 feet draught outwards.

The depths in the channels to Moulmein vary considerably, but there are seldom less than 12 feet at low water springs in the lower part of the river, thus enabling a vessel of 22 feet draught to proceed at neap tides as far as Lower Anchoring creek, about 12 miles southward of Moulmein.

DOUBLE ISLAND, $12\frac{1}{2}$ miles S. $\frac{3}{4}$ E. from Amherst point, is small, steep to all round, and about $5\frac{1}{3}$ miles from the coast.

The island is about 100 feet high and well wooded but not easily distinguished from a distance seaward, under the high land. A small portion is cultivated by the keepers of the lighthouse. Its double appearance caused by a cleft in the trees, is most apparent when it bears between N.E. by E. and S.E. Approaching Double island at night a vessel should sound frequently, and not get into less than 12 fathoms before the light is sighted.

Landing on Double island is difficult in bad weather. The landing place is close to a crane on the east side of the island.

* See Admiralty charts :—Bay of Bengal, sheet 3 ; Koronge island to White point, including the gulf of Martaban, No. 823 ; Moulmein river and Amherst road, No. 1845. Admiralty plan of Moulmein harbour, No. 1646 ; scale, $m = 2.97$ inches. Also, No. 1693 of River Salween ; scale, $m = 0.94$ inches.

LIGHT.—On Double island is a stone lighthouse 75 feet in height, from which is exhibited at an elevation of 164 feet above high water, a *fixed white* light, visible between the bearings of N. $\frac{3}{4}$ W. through east and S.S.E., from a distance of 19 miles in clear weather. The former bearing leads $1\frac{1}{4}$ miles westward of Kalegauk island, and the latter half a mile westward of the Patch buoy off Amherst. A sector of light shows from the Patch buoy eastward as far as Amherst point.

Vessels making the light, should endeavour to keep it between the bearings of S.E. and N.E., paying particular attention to the tides, as at springs they run about 5 knots an hour, parallel with the coast. Vessels standing too close to the land will lose sight of the light, but so long as the light is in sight there will be no danger until 10 miles northward of it, when approaching the Goodwin sands, where the tides run very strongly. The anchoring ground in the vicinity of Double island is good, but, on account of the strength of the tides, vessels should avoid as much as possible the risk of anchoring in such deep water.

AMHERST POINT the south entrance point to Moulmein river, terminates in a bluff point about 13 feet high; the shore southward being composed of low cliffs covered with brushwood, with a foreshore of sand and scattered rocks. On the extreme point are three pagodas close together and a conspicuously tall palm tree. Immediately below Amherst point, on a high rock which is surrounded by water at high tide, is the Water pagoda; and on the rocky point, three-quarters of a mile to the southward, is another pagoda. Tsheng Taung, a wooded hill 950 feet high, and $4\frac{1}{2}$ miles south-eastward of Amherst point, is the most conspicuous feature in the vicinity.

Telegraph and signal station.—The telegraph and signal station is situated near the pagados on Amherst point.

STORM SIGNALS are shown from the above signal station. For details of signals, *see* page 27.

The **MOULMEIN MOUTH** of the **SALWEEN** extends from Amherst point northward to the south point of Balugyun island, between which it is $9\frac{1}{2}$ miles wide. The entrance is encumbered by extensive sandbanks.

Caution.—Information was received in 1890 that the channels into the Moulmein river had entirely altered since the survey made in 1877. The only available channel is now northward of Balugyun

sands, and is marked by black buoys on the starboard hand and red buoys on the port hand, entering from seaward. In consequence of the frequent changes in the channels no stranger should attempt to enter Moulmein river without a pilot.

Pilots.—In fine weather small pilot schooners cruise between the entrance of the river and Double island, about 15 miles to the southward. If a pilot has not been previously obtained, a vessel should anchor off Green island, and on the signal being made a pilot will be sent from Amherst.

Green island, lying S.S.W., one mile from Amherst point, is about 30 feet high and covered with trees and brushwood, with a clump on its summit. This island is surrounded by a bank with rocks and boulders on it. Vessels should not approach within half a mile of Green island.

Long Stones reef.—From Amherst point a reef of rocks consisting of isolated groups, with deep water between them, extends $1\frac{3}{4}$ miles in a north-west direction. The highest rocks of this reef dry at about half tide: thus when the rocks are covered, the tide has risen over 11 feet. A black buoy, known as the Reef buoy, is moored at the north-west extreme of Long Stones reef.

The Patch, on which there is a depth of 9 feet, lies W. by N. $\frac{3}{4}$ N. 2 miles from Amherst point. A black buoy with staff and ball is moored nearly 2 cables westward of the patch.

Balugyun sands, the largest of the above-mentioned banks, is $4\frac{1}{2}$ miles long by $2\frac{3}{4}$ miles wide; its sea face lying in line with the coast nearly north and south across the mouth of the river; it is steep-to on the west side, there being from $7\frac{1}{2}$ to 9 fathoms at low-water at from 7 to 5 cables from the sand. Further seaward the water shoals to $6\frac{1}{2}$ fathoms, leaving close to the edge of the sands a deeper channel, apparently caused by the main tidal stream of Sittang river taking this direction and preserving the steep sea face of the sand.

Goodwin sand, a detached bank, lies south of Balugyun sands, from which it is separated by a shallow channel.

In consequence of the frequent changes, the dangers and channels within the entrance of the river will not be described. The successful navigation of the channels can only be performed by local pilots.

Outer anchorage.—The best anchorage for vessels outside the river is in from 6 to 9 fathoms, with Green island between the bearings S.E. by E. $\frac{1}{2}$ E. and N.E. $\frac{1}{2}$ N., distant one mile. The holding

ground is good, but during spring tides the tidal stream at this anchorage runs with great velocity, and it is necessary to give a vessel plenty of cable.

Vessels should not, except from necessity, anchor north of the entrance, as the holding ground is not good, and the combined tides of the Sittang and Moulmein rivers are exceptionally strong, sometimes attaining a velocity of 7 knots an hour.

AMHERST.—Just inside Amherst point is the small village of Amherst (Kyaik Khami), containing only a native population. There is a post office at the village, and a telegraph office on the point, in connection with Moulmein, to which there is a good carriage road, the distance by which is 56 miles.

Tides.—It is high water, full and change, at Amherst at 2 hrs. 15 m.; springs rise 22 feet; and neaps 12 feet. Ten miles northward of Amherst the tide is about one hour later. Outside the entrance, the flood stream sets to the northward along the coast, the ebb to the southward; and the velocity of the stream, augmented on the ebb by the water from the Sittang and Salween rivers, is very great. Off the entrance to Moulmein river the set of the flood stream is towards Long Stones reef and the channel north of it. The streams within take various directions through the numerous channels between the banks.

When the outer banks are covered, the flood stream sets strongly to the eastward over the sands. In the month of August the river is much swollen by the rains, the tide rising 26 to 28 feet, and the stream attaining a velocity of 7 knots an hour. The flood stream ceases almost immediately after it is high water, but the ebb stream runs from one to $1\frac{1}{2}$ hours after it is low water at Amherst. At Lower anchoring creek the ebb stream runs from 2 to $2\frac{1}{2}$ hours after it is low water at Amherst, and the flood for one hour after it is high water at Amherst.

Winds and Weather.—In December the wind is chiefly from north-east to east, light, and sometimes veering to north and even north-west; the weather fine and clear. In January the wind continues light from the same quarter, but in the early part of the month the mornings and evenings are misty, though the weather is fine; towards the end of January the wind veers more to the south-east, and the weather becomes foggy. In February light land and sea breezes set in, the land breeze being from east and north-east, the sea breeze from west and north-west. The weather is fine, but the fogs become frequent and thick towards the end of the month. In March the land and sea

breezes continue, the land breeze being from south-east and the sea breeze from south-west, the former light, but the latter sets in with strength and blows fresh at Amherst between 2 and 4 P.M., after which it dies away. The weather is fine, but thick fogs, which last for three and four days at a time, occur throughout the month.

At this time the navigation of the river becomes difficult, as the fogs obscure even the banks of the river. During this month the natives light large fires to burn the paddy husk and straw, and the dense smoke helps to envelope the country in obscurity.

From July to September the weather is very stormy.

DIRECTIONS.—Bound to Moulmein from the bay of Bengal, a vessel should, after passing Alguada light, steer to make Krishna light. *See* page 321. After making Krishna light and bringing it to bear North, distant about 8 miles, the depth then being about 14 fathoms, a course should be shaped for Double island light (distant from the Krishna 120 miles). Stand in towards Double island to within 2 or 3 miles, and then haul up to the northward for Amherst point. A swatch of 14 fathoms, with 11 fathoms on either side of it, is situated about 20 miles westward of Double island.

In thick weather during the south-west monsoon, and the position of the ship being doubtful, it will be advisable to keep well to the southward and make the land a little south of Kalegawk island or in lat. 15° 30' N. In the event of bad weather, more particularly if it be at or near spring tides, a vessel should not proceed towards the anchorage off Amherst, but run up inside Kalegawk island, and anchor in from 6 to 9 fathoms.

In clear weather, and often on a bright moonlight night, the high mountains in the interior, east of Double island, will be seen before the light is sighted.

As the land near the river is seldom to be seen at a greater distance than half a mile during March, it is imperative that vessels bound for Moulmein should then make the land well to the southward, and sight Double island before steering for the river.*

As the tide sets with great velocity along the coast, care must be taken at night not to be swept to the northward of the entrance to Moulmein river, as there is no light on Amherst point to guide vessels. By keeping Double island light in sight bearing eastward

* Vessels frequently get on shore in the fogs on Balugyun and Goodwin sands in consequence of keeping too far to the northward; and as the banks are steep to, the lead gives no warning of an approach to danger.

of S.E. by S., the vessel will be kept well clear of danger ; but as before mentioned, great care must be taken not to stand too far to the northward, it being better to anchor well to the southward of the river.

Caution.—When standing to the northward, a constant look-out must be kept on the light, as a vessel may, by being set in towards the shore, lose sight of the light, cross the obscured arc, and re-sight the light again when close to the rocks.

Anchorage may be had in from 9 to 11 fathoms between Double island and Green island, at about $4\frac{1}{2}$ miles off shore.

From Rangoon to Moulmein.—In shaping a course care must be taken to allow for the state and time of tide during the passage, or the vessel may, especially in foggy weather, be placed in a dangerous position.

At this time great attention should be paid to the lead, and the vessel should not shoal to less than $5\frac{1}{2}$ or 6 fathoms at low water. Having run nearly the distance, should the weather be thick and the land not discernible, it would be prudent to anchor immediately if there is the slightest indication of deepening the water to over 7 fathoms (low water), as the deepest water (9 to 11 fathoms) is close to the sands. In fine clear weather, the lofty, sharp, conical peak of the Zingyaik mountains, north of Balugyun, will be seen on approaching the river from Rangoon. From 10 to 15 miles in the interior, south and east of Amherst, are lofty hill ranges and peaks, which in clear weather are seen 30 to 45 miles distant.*

MOULMEIN is 30 miles from the entrance at Amherst by the course of the river ; it is built on the left bank of the river, is clean, and has some fairly substantial buildings. In 1891 the population numbered 55,000. On a low ridge behind the town are several pagodas. The Master Attendant's, Custom, and Post offices are on the banks of the river. There is a good iron landing pier opposite the former, and the river bank is bunded for some distance. Vessels

* In the gulf of Martaban, the south-west monsoon may, after May 20th, be said to have fairly set in, although it is occasionally later. From this date to August 20th, a great deal of bad weather is experienced. Vessels leaving between the dates mentioned should be prepared for a trying passage, especially from Moulmein. The weather should be considered previous to leaving, because with a prevalence of bad weather about the full and change of the moon, it is possible a few days of moderately good weather will follow, of which advantage should be taken.—Captain N. Heckford's *Sailing Directions for Bay of Bengal*, 7th edition, pp. 82, 83.

should moor off Moulmein, as they cannot lie at single anchor there. There are no tugs at Moulmein.

Tides.—It is high water, full and change, at Moulmein at 4h. 30m. Springs rise 14 to 15 feet, neaps rise 11 to 12 feet. Extraordinary springs sometimes rise 17 feet.

Coal can only be obtained in small quantities. It is shipped in lighters carrying from 20 to 60 tons. Coasting steamers occasionally coal at a floating jetty, which has a depth of 10 feet alongside at low water springs.

Jetty.—In addition to the above jetty, there is another floating jetty at Moulmein, with a depth of 21 feet alongside at low water springs.

Dock.—The dry dock at Moulmein is silted up and unserviceable. The gridiron is capable of taking a vessel of 300 tons, or one up to 150 in length and of 9 feet draught.

Repairs.—Only small repairs can be executed at Moulmein ; there are no works capable of undertaking heavier repairs than could be effected by any of H.M. Ships.

Communication.—There is steam communication with Rangoon every alternate day, the local steamers employed making the passage in 9 hours ; with Calcutta by B. I. S. N. steamers weekly ; also to Calcutta direct, and via Rangoon, by the steamers of the A. S. N. Co. Coasting steamers connect with the southern provincial ports of Tavoy and Mergui fortnightly. A regular steam service is not maintained to the Straits Settlements, communication only being kept up as required, but sometimes two or three vessels leave Moulmein for them in a month. Moulmein is connected with the telegraphic system of India. It has no railway connection.

Supplies of fresh provisions and vegetables can be obtained at moderate rates. Vessels supply themselves with water from the river, which at certain times of tide is quite fresh, and fit to drink.

Trade.—Shipping.—The chief export is timber ; valued in 1890 at 800,000 rupees. The import trade in that year was valued at 1,000,000 rupees. In 1890 the port was visited by 600 vessels of 300,000 aggregate tons.

Quarantine.—Vessels coming from infected ports, or having had sickness or death on board during the voyage, notify the information to the Port Officer by hoisting the quarantine flag at Amherst,

afterwards anchoring at Anchoring creek, and there awaiting further orders.

Hospital.—There is a hospital at Moulmein, with accommodation for 20 seamen. A Sailors' Home has not been established.

Climate, &c.—The following table is from observations taken at Moulmein at an elevation of 94 feet above sea level.

Month.	Temperature.					Humidity.		Cloud.	Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range.		Mean.	Mean.		Inches.	Days.	Mean.	Daily Range.
				Daily.	Month.							
January - -	75	89	64	25	34	63	0·8	...	...	29·89	·12	
February - -	77	92	66	26	35	63	0·7	0·1	...	—·84	·12	
March - -	81	94	72	22	31	66	0·6	0·1	...	—·81	·13	
April - -	83	95	76	19	27	69	2·4	3·0	7	—·75	·13	
May - -	82	91	76	15	24	76	5·0	19·7	18	—·70	·12	
June - -	78	84	75	9	18	89	8·2	38·4	28	—·68	·09	
July - -	77	83	74	9	15	90	8·3	43·9	29	—·68	·08	
August - -	77	83	74	9	18	91	8·2	43·0	28	—·69	·09	
September - -	78	84	74	10	18	87	6·3	30·3	27	—·72	·11	
October - -	80	88	74	14	20	81	3·2	8·4	15	—·76	·12	
November - -	78	88	72	16	26	74	1·7	1·5	5	—·80	·11	
December - -	76	87	67	20	30	70	1·3	0·1	1	—·85	·11	

THE COAST outside the river, from Pagoda point abreast Green island of Amherst, trends to the south-east for about 19 miles, then curves to the south-west for 4 miles to Bluff point, forming a bay the water in which appears shallow. Eastward of Double island in this bay, an extensive flat is said to exist, and the south-east part of the bay is bordered by a low shore which should not be approached. Under ordinary circumstances of navigation no vessel should pass inside of Double island. The land southward of Amherst is mostly high and may be seen 30 miles off.

North Rocks, of which there are two detached groups bearing north-east and south-west of each other, $1\frac{1}{2}$ miles apart, are about 20 feet high, but should not be approached on the western side nearer than a distance of $2\frac{1}{2}$ miles, or eastward of the southern

limit of visibility of the light on Double island. North rocks lie south-east of Double island, distant about 6 miles, and are about $2\frac{1}{2}$ miles north-west of Bluff point.

KALEGAUK ISLAND, the north point of which bears S. by E. $\frac{1}{4}$ E., 17 miles from the lighthouse on Double island, affords an important land fall, during the south-west monsoon for vessels bound to Moulmein; at which time, Bentinck sound, between Kalegauk and the main, offers safe anchorage for vessels of any size. The island is $5\frac{3}{4}$ miles in length, north and south, or parallel with the shore, by $1\frac{1}{4}$ miles in extreme width, and is formed of several hummocks, the northern of which, mount Woodstock, elevated about 350 feet, is the highest. Forests of fine trees clothe the entire island. A quarter of a mile south of the south point is Cavendish islet, from which a reef extends in a southerly direction for about a quarter of a mile. The west side of Kalegauk island is said to be lined with reef and should not be approached nearer than 2 miles.

When seen from the westward, against the high land at the back, this island appears low, like a flat foreshore to the higher hills. Near Kalegauk island, Tsheng Taung, south-eastward of Amherst, shows up like an island, and is a useful mark.

Galloper Sand, between which and the north end of Kalegauk island is a narrow 5 fathoms channel, through which the tide sweeps at the rate of 5 knots, is a shoal, extending in a N. by E. direction, for a distance of nearly 6 miles. A considerable part of Galloper sand dries at low water. Abreast its northern end is Pulo Kropik or Tree island, about a mile from the mainland, and between the island and north end of Galloper sand is the north channel into Bentinck sound, about three-quarters of a mile wide, and with depths of 10 fathoms. At about 3 miles from its south end, Galloper sand appears almost divided into two parts by a narrow channel.

BENTINCK SOUND,* between Kalegauk island and Galloper sand on the west side, and the mainland on the east, affords secure anchorage especially during the south-west monsoon, in from 6 to 8 fathoms over a space $3\frac{1}{2}$ miles in width by nearly 10 miles in length. The best position is in 6 to 7 fathoms, about a mile north-east of Steep point, which point is about the centre of the east side of the island.

In entering from the southward pass at a distance of about a mile from Cavendish islet and haul to the northward, maintaining a

* See Admiralty plan of Bentinck sound, No. 835; scale, $m = 0.98$ inches.

distance of about a mile from the east coast of Kalegauk island, anchoring about a mile north-east of Steep point.

Supplies.—A stream of fresh water flows through the centre of Kalegauk island, and at Mahomet's well, even during the dry season, 3 or 4 tons of excellent water per day, could be procured. Supplies of buffaloes and rice were obtained in H.M.S. *Satellite* at a village up Dermonjai creek on the mainland, on the south-east side of the sound. Wood and fruit were also procurable.

Tides.—It is high water, full and change, in Bentinck sound at 0h. 50m. Springs rise 19 to 22 feet. The tidal stream, near the anchorage off Steep point, runs $3\frac{1}{2}$ knots. In the offing outside Kalegauk island, at a distance of about 7 miles from the land, the flood stream at spring tides, was found by Captain Ross, I.N., to run from 3 to 4 knots, increasing in strength as the entrance to Moulmein river was approached.

THE COAST from Dermonjai creek, on the south-east side of Bentinck sound, trends to the southward for 21 miles, and increases in height to an altitude of 1,500 feet at Pagoda point, the north point of entrance of the river Yé. This ridge of high land is visible from a distance of 30 miles. Several small islets or reefs lie near the shore on this part of the coast, rendering it prudent to give it a berth of 4 or 5 miles, and advisable not to shoal the water below 12 fathoms. The flood stream at springs, runs 3 knots an hour to the northward, along this part of the coast.

Soundings.—Recent soundings show that in lat. 15° N., the bank, with depths less than 20 fathoms, extends from the shore to long. $96^{\circ} 50'$ E., and may extend considerably farther eastward a little northward of that parallel.*

Approaches.—**YÉ RIVER.**†—Four and a half miles north of the mouth of Yé river the high land touches the coast and the summit, 1,540 feet, is thickly wooded. Here the shore is steep and rocky; a small creek lies on the south side of this high land, and thence to Pagoda point extends a sandy beach fringed with jungle.

Pagoda point, rising abruptly from the beach, forms the north entrance point of Yé river, and is a conspicuous hillock, 150 feet high, surmounted by a small pagoda. Sidaw taung, a bold headland

* Mr. Greenhorn, Master of the steamer *City of Dublin* has reported a depth of 26 fathoms in lat. $15^{\circ} 5' N.$, long. $96^{\circ} 20' E.$ July, 1891.

† See Admiralty chart:—Approaches to Yé river, No. 1,272. The description of Yé river and its approaches is derived from remarks by Commander A. Carpenter, R.N., in charge of Marine Survey of India, 1887.

580 feet high, forms the south entrance point. From the west and north-west it is comparatively flat topped, but from the south it appears conical.

South of Sidaw taung for a distance of 9 miles the coast is low and sandy with small headlands here and there, but the high ranges at the back give it the appearance of being steep.

At 9 miles from Sidaw taung the high land closes the coast and the headlands become larger until White point is reached, which is 19 miles south of the river. North and South peaks, 2,500 feet high and $1\frac{3}{4}$ miles apart, lie about 7 miles to northward of White point and $3\frac{1}{2}$ miles inland, but as there are other peaks of nearly the same height they are not readily distinguishable.

Aye island, $7\frac{1}{2}$ miles north of the entrance of Yé river and half a mile off shore, is 490 feet high, with steep sides and thickly wooded.

Toby Rock, lying 6 cables from the shore, $3\frac{1}{2}$ miles N.N.W. of Stag island, is a rocky ledge 3 cables long, which nearly covers at high water, and has 6 to 7 fathoms round it.

Stag island.—The northernmost of the main group, lying off the mouth of the river, has two summits, the northern being 444 feet high. Its western side is steep, but on its eastern side there is a beach, where fresh water can be obtained. A spit extends three-quarters of a mile off the north point of the island.

Nat gyun, 153 feet, and Bath Bun, 444 feet high, are two small islands lying south of Stag island, and separated from it by a deep channel, which however is not recommended. They stand on a ridge of hard sand which extends nearly down to Pig islands and which dries at very low spring tides.

A small group of rocks awash at high water lies 2 cables N.N.W. of Nat gyun. Three cables south-west of the west extreme of Bath Bun island is Ghorparay rock, which dries about 3 feet.

Depths of 7 to 8 fathoms, even bottom, sand and mud, are found one mile west of the ridge on which these islands stand.

Kyetiki gyun, a low wooded islet, with trees 70 to 80 feet high, lies $1\frac{1}{4}$ miles E.S.E. of Bath Bun island, and stands between two shoals in the inner channel to be described presently.

PIG ISLAND.—Has the appearance of four islets. It consists of four distinct wooded hills connected by low sandy beaches, the southernmost and largest hill being 534 feet high, and steep on its eastern side. Shallow sands extend off the western side of the island for $1\frac{1}{2}$ miles, and a shoal ridge 5 miles long, on which the sea

incessantly breaks, lies immediately S.W. of it. This shoal trends north and south and its southern extreme is $4\frac{3}{4}$ miles south of Pig island. Deep water exists immediately east of Pig island and across to the mainland forming a good channel and secure anchorage.

Tamarind island, lying $1\frac{1}{2}$ miles off shore and $4\frac{1}{2}$ miles S.S.E. of Pig island, is 260 feet high, and is a small triangular-shaped islet. The deep channel passes close to the westward of it.

Hoare island, lying $3\frac{1}{2}$ miles further to S.S.E., is another somewhat similar but lower islet.

Livermore shoal is a ridge of sand $2\frac{1}{2}$ miles long north and south, having not less than 3 fathoms on it at low water. Its centre lies $3\frac{1}{4}$ miles W. by N. of Stag island, and the 10-fathoms line passes close outside of it. Pagoda point seen clear of north end of Stag island bearing S.E. by E. $\frac{3}{4}$ E. leads to the northward of this shoal and the west extreme of Aye island bearing N.N.E. leads clear on the seaward side, but the lead is the best guide for vessels passing up and down the coast, and not less than 12 fathoms should be obtained in its vicinity.

ROSS SAND, $6\frac{1}{2}$ miles from the coast and believed to be the outer danger off White point, is 6 miles long in a north and south direction, and has its northern extreme almost overlapping the long shoal off the south-west end of Pig island. Its north end is the shallowest part having only $1\frac{1}{2}$ fathoms hard sand, whilst the general depth is 4 fathoms on the ridge, with a lump of 3 fathoms near the south end. It is barely a mile in breadth anywhere, is steepest on its eastern side, and is generally discernible by discolouration and tide rips. No directions can be given for clearing the sand and the lead is of little use. Bearings of Stag island, Moskos islands, and North and South peaks will be useful for ascertaining position.

From the above remarks it will be seen that a chain of islands and shoal ridges extends for about 21 miles parallel to the coast with no passages between them that can be recommended.

Pascoe shoal, lying immediately off the bar of the river, is a narrow shoal of sand 2 miles long north and south. Its north end lies one mile S.W. by W. from Pagoda point, and its south extreme is a little south of Kyetiki gyun. The safe channel is eastward of this shoal; and a useful leading mark, Aye island kept just touching the mainland, leads through it. The centre of this shoal dries at low water springs when there is not less depth than 4 fathoms in the channel.

Simpson shoal, trending south for $2\frac{1}{4}$ miles from Kyetiki island, is similar in shape to Pascoe bank and has a least depth of one fathom, sand and mud, near its centre. Its south end is 6 miles S. by E. of the north end of Stag island, leaving a channel half a mile wide between this bank and the end of the long bank extending south from Bath Bun island. This channel can be used by keeping Bath Bun and Stag island just touching; but a stranger would probably prefer that east of Pascoe shoal. The east side of Simpson shoal is cleared by keeping Kyetiki islet showing to the left of the high land over the coast to the northward.

Tides.—It is high water, full and change, at Stag island at 11h. 55m. Springs rise 18 feet, neaps rise 12 feet. The lowest tides are in February and March. Inside the bar high water is nearly at the same time as outside, but the times of low water differ considerably, the escape of water at the bar being checked by the sands so that the tide outside commences to rise some time before that inside. Owing to this check the level of the water inside the bar at springs never falls so low as that outside. When allowing for the rise of tide above the soundings on the chart it must be borne in mind that there is 3 feet less rise on the bar than there is outside. Owing to this, although neaps are stated to rise 12 feet at Stag island, they only rise 9 feet on the bar; and with minimum range only $7\frac{1}{2}$ feet. As the bar nearly dries this limits the entrance, at ordinary high water neaps, to vessels of less than 7 feet draught.

Tidal streams.—The flood tide sets along the coast to the northward, running about 3 knots at springs. The ebb sets in a similar manner to the southward. At springs the water is much discoloured outside the islands.

Anchorage.—There is good anchorage for large vessels east of Stag island, and also east of Pascoe bank, anchoring on the leading mark, Aye island just touching the mainland, and Kyetiki islet bearing S.S.W. $\frac{1}{2}$ W. To the southward there is good anchorage east of Pig island.

DIRECTIONS.—Approaching from northward Kalegauk island will probably have been sighted, after which Aye island under the high land, and Stag island further out, will have been seen. On approaching Stag island on a S.E. by S. course, which leads $1\frac{1}{2}$ miles from Aye island, Pagoda point will be recognised as a hummock at the end of a level stretch of beach. Bring it to bear S.E. $\frac{3}{4}$ E., when it will be on with the western slope of Sidaw taung and in line with a dip in the distant high land. See View on chart, No. 1272. This

course keeps clear of the spit off the north end of Stag island and leads on to the next line, namely, Aye island touching the mainland bearing N.N.W. westerly, keeping which astern leads to anchorage either east of Stag island, or if intending to take in cargo, east of Pascoe shoal.

Approaching from southward.—Pass inside Ross sand, which is generally visible by discolouration and tide ripples. with Pig island bearing North until Tamarind island bears N.E. or South peak E. $\frac{1}{2}$ N. Then steer to pass one mile west of Tamarind island, and midway between Pig island and the mainland until Pagoda point is seen bearing North in line with a notched peak a short distance behind it. This course leads east of Simpson shoal and brings the vessel to a position off the bar if necessary east of Pascoe shoal.

YÉ RIVER, which enters the sea between Pagoda point and Sidaw taung, is said to have its source beyond the British frontier in Siam, and after passing through the hills east of Yé district flows through a cultivated land past Yé town, after which it follows a very twisted course to the sea, breaking into two branches about half way, which join again near the mouth and form a large island between them. Owing to its sharp turns there are numerous sands which are difficult to avoid, and it is only navigable for short vessels drawing less than 7 feet at neaps ; but vessels drawing 13 feet might reach the town at spring tides.

Bar marks.—The western mark, a diamond on a pole near the fishing stakes 6 cables north-east of Sidaw point. The eastern mark, a white globe in a tree at the edge of the mangrove north-east of Sidaw point. These marks are used for the outer part of the bar.

For the inner part of the bar there stands in a tree a little distance north of eastern mark a triangle and diamond painted red.

On the bluff, the west extreme of the hill Sidaw taung, on the south side of the entrance, are two white balls, one on a pole on an outlying rock off the bluff, and the other on a tree on the east end of the same bluff.

At the mouth of the creek, Oagi Chaung, is a white ball in a tree, used for clearing the sands when across the bar and heading up the river.

To cross the bar.—We may presume that high water would naturally be chosen for doing this both for increased depth on the bar and so as not to carry a strong flood up the river, which would be fatal to steering round its sudden bends.

At high water neaps, as already stated, not more than $7\frac{1}{2}$ feet of water can be depended on, but within a day or two of spring tides 12 feet can always be got at high water in the channel.

With the left extreme of the bluff under Sidaw taung bearing N.E. by E. the eastern and western marks will be made out a little to the left of it. Keeping the eastern mark (*see* description) just open to the right of the western mark, steer in until the bend of the beach, one mile north of Pagoda point, is nearly shut in by that point, when steer one point to the northward to bring the two globes on the near bluff of Sidaw in line with one another E.N.E.; when in line steer over for them until western mark comes on with the triangle and diamond in the trees to the north of eastern mark. Now steer with these new leading marks in line until the extreme of the bluff bears South when keep a little to the northward again, bringing western mark *between* the marks to the eastward in the trees. This leads the vessel in until the next reach of the river opens up to the northward. Asun pagoda, a conspicuous object on the proper right bank, will now open clear of Zibuthang point, which is the inner extreme of the entrance on the north side. Keeping it well open to avoid a steep sand running S. by E. from Zibuthang point steer to pass the latter point at half a cable distant. Oagi Chaung mark bearing N. by W. $\frac{1}{2}$ W. in line with Asun hill also leads up this reach.

The river here divides into two branches, the one to the northward past the pagoda being quite shallow when examined in 1887, the other, Zibuthung reach, which will be seen opening to the N.E. is comparatively straight, and leads, by somewhat intricate navigation, to the town of Yé.

Tides.—Inside the bar of the river it is high water, full and change, at 12h.; springs rise 15 feet, neaps rise $8\frac{1}{2}$ feet. At Yé town it is high water, full and change, at 1h. 08m. approximate; springs rise 13 feet, neaps rise $6\frac{1}{2}$ feet.

Over the bar and inside the river the first of the flood sets in the line of the channels, but when the sands are covered and at neaps, when they do not uncover, it sets for Zibuthang point. The ebb acts similarly in a contrary direction and tends to set a vessel coming down the last reach on to the sands south of Zibuthang point. It is very strong in the channels after the sands are uncovered and off Sidaw point runs 4 knots.

In the upper reaches the tide ebbs and flows in the direction of the channels, eddies being met with under the lee of the bends. At Yé the floods runs up for about 5 hours.

Climate.—Fine weather prevails from middle of November to middle of March. Northerly and easterly winds prevail during the day, and westerly breezes in the afternoon during February and March.

During February the weather is frequently hazy for several days, distant objects being obscured. The rainy season does not end till 15th November, and up to that date fever is prevalent. The temperature near the mouth of the river ranges from 80° to 90° at midday between November and March, and 60° to 70° in the early morning.

Yé, situated 7 miles north-eastward the bar, is the capital of Yé district, which lies between Amherst and Tavoy in the province of Tenasserim. The range of hills on the south side of the river entrance forms a boundary between Yé and Tavoy districts.

The town stands on the north bank of the river on high ground and its pagodas are conspicuous for many miles.

Trade consists chiefly in the import of tobacco, cotton and silk piece goods, earthenware and porcelain; and export of paddy, salt, dunnies, sessamum and boats' hulls.

Population of Yé town is 3,350 and for the whole district 16,466.

Supplies.—Rice, fish and vegetables are easily obtainable, but not coal, wood being used as fuel by the trading steamer, a supply of which she obtains at Yé.

There are two piers built of wood, but the foundations of the older one having sunk it is rendered almost useless.

Communication.—There is telegraphic and postal communication, and a steamer runs to Moulmein and Tavoy monthly.

THE COAST from White point, in lat. 14° 53' N., trends S.S.E. about 48 miles to lat. 14° 8' N., where, facing the sea, is a bungalow, the residence of European officials connected with the jurisdiction of the Tavoy district, the town of which name lies about 9 miles south-east of it.

MOSKOS ISLANDS, consisting of three groups, Northern, Middle, and Southern, which are known to the Burmese as Hinzé, Maungmagan, and Laung lun, extend in a chain parallel to the coast, distant from it from 8 to 14 miles, between the parallels of 14° 32' N. and 13° 47' N. Between the islands and the coast is a channel carrying soundings of 10 and 17 fathoms. Several of the islands are upwards of 1,000 feet in height.

The coast bank of soundings appears to extend a great distance westward of the Moskos, there being depths of 50 fathoms at a distance of 65 miles in that direction.

Northern Moskos, almost united to the Middle Moskos by scattered islands and rocks; are composed of straggling islands of various sizes, with several rocks above water. From the northern island mount Nabulé bears E. by S. 16 miles. Reefs are situated at distances of $1\frac{1}{2}$ and 2 miles, from the north island of Northern Moskos, bearing respectively E. by S. and N. $\frac{1}{2}$ E. Near the latter is North rock, 28 feet high.

North ledge, about 7 miles from the mainland and $4\frac{1}{2}$ miles N.N.E. $\frac{3}{4}$ E. from North island, is 3 feet high, with apparently no other rocks near it.

Middle and Southern Moskos contain the largest and highest islands in the group, for the description of which the chart is the best guide. The channel between these groups, about 12 miles wide, is believed to be free from danger, and the islands appear steep to on their western side.

Vessels by day proceeding inside Moskos islands, pass eastward of North ledge, being warned of approach to Hinzé banks by the lead.

Mount Nabulé.—The high mountain in lat. $14^{\circ} 24'$ N. is named Nabulé, and is 3,805 feet high. It shows as a fine peak when seen from the northward or southward, but blunt when seen from the westward.

HINZÉ BASIN.—From White point a bold rocky coast trends S.S.E. for $11\frac{1}{2}$ miles to Hinzé basin, the entrance point of which is named Dolphin's nose. From the nose, shoal water extends S.W. by S. 6 miles, the sands drying out at low water springs for $2\frac{1}{2}$ miles, covered by 2 or 3 feet water for another mile, and then deepening to $4\frac{1}{2}$ fathoms. Vessels approaching from the southward should keep 7 miles from the shore, but if desirous of communicating with the basin by boat, the shore north-eastward of northern Moskos island can be approached nearer; or by steering for Dolphin's nose, bearing between E. by N. and E. by S., anchorage may be obtained in $4\frac{1}{2}$ fathoms at $1\frac{1}{4}$ miles distant from the west coast of Dolphin's nose.

Hinzé basin is about 20 miles long north and south, with the main entrance nearly equidistant from the extremes of the lake.* The width of the basin is one to 3 miles, and the depth 2 to 6 fathoms. The entrance between hills 700 feet high is about a mile wide in the

* There are, it is said, two other outlets, both quite shallow, and probably closed in the dry season.

narrows, and is over 8 fathoms deep in parts; but two rocky heads show at low water on the north side of the narrows, and there may be more such dangers. Outside, the sands are an effectual bar, and nothing is known of the channels between them. A boat may enter at high water from the anchorage off Dolphin's nose by steering for the bluff on the north side of the narrows bearing East; this will lead across a narrow sand 6 cables south of the nose, after which she may follow the shore until inside the basin. High water inside the basin appeared to be half an hour later than that outside. The tidal streams run with great strength in the entrance. A great quantity of foliage is swept out by the ebb.

THE COAST from the Government bungalow, in about lat. $14^{\circ} 8' N.$, trends South and S. by E. for about 37 miles to Tavoy point on the west side of entrance to Tavoy river. The sea face of this part of the coast appears bold and rocky, but its northern part is skirted by sunken reefs to the distance of about a mile. A hilly ridge extends along this part at a short distance from the coast, having in about lat. $13^{\circ} 55\frac{1}{2}' N.$ a hill with a pagoda, and in about lat. $13^{\circ} 48' N.$ a bluff headland or point, with rocks awash off it. There are also several small islands without names, for the position of which the chart should be referred to. The Tavoy river runs up in a northerly direction or parallel to this part of the coast from which it is distant about 9 miles, and for the description of which see next Chapter.

Cap islet, about 2 miles westward of Tavoy point and three-quarters of a mile from the shore, is small, round, and bushy, and affords a good mark for vessels approaching from the north-west.

TAVOY POINT, in lat. $13^{\circ} 32' N.$ is a moderately high bluff, covered with trees, and has a pagoda near its extremity, conspicuous when seen from the westward. Immediately within Tavoy point there is good anchorage for a large vessel in 6 fathoms, soft even bottom, with the point bearing S.W. by S., distant about one mile.

CHAPTER IX.

COASTS OF TENASSERIM AND SIAM WITH MERGUI ARCHIPELAGO.—TAVOY RIVER TO JUNKSEYLOON AND BROTHERS ISLANDS.

 VARIATION 3° E. IN 1892.

TAVOY RIVER* has its main sources near the north boundary of Tavoy district, in the western slopes of the range forming the boundary between Burma and Siam, and is about 120 miles in length, and navigable for short vessels of 8 feet draught as far as Tavoy, 30 miles from the mouth; vessels of 12 feet draught can ascend for 19 miles. From Nyaung daung lai to Rwon lai, which is about 32 miles northward of Tavoy, it is navigable for small boats only, below this the rapids cease, and tides are felt. Three miles above Tavoy the river enters a broad plain, its course impeded by sand banks and alluvial islands, constantly changing in form and position. These obstruct the course of the river until the estuary is reached, into the north-east corner of which, three small rivers fall, the mouths of which are blocked by sand and mud flats. Many tidal creeks intersect the plain between the banks and the base of the hills on either side of the river.

The hills run in parallel ranges generally north and south. At Tavoy point (Shin maw) they rise directly from the coast line to a height of 1,120 feet, gradually receding from the river along the right bank, and at Goodridge plains are $1\frac{1}{2}$ miles off, and nearly 2,000 feet high. They gradually close the bank abreast of Tavoy.

On the left bank of the estuary are low coast hills, with parallel ridges behind them gradually increasing in height to Nyataung range, 4,000 feet above the sea. Buktaung, 2,195 feet, is abrupt and conspicuous, rising from a small range near the coast; and to the northward Thejaungtaung, similar in appearance, is also conspicuous, and makes a good mark to steer for after rounding Shin maw and before shaping course up the river. Northward of Elbow point (Thamókmo), the hills close the left bank, and at Tsinbyubyin are $1\frac{1}{4}$ miles off, maintaining about that distance to Tavoy, where they

* See Admiralty Charts :—Bengal, east coast, sheet 4, White point to Mergui, No. 824; Tavoy river, No. 924; scale, $m = 1$ inch.

recede. They increase in altitude in successive ranges until the final Nwa la bo range with its conspicuous peak, 5,000 feet high, bounds the view.

The town of Tavoy, the head-quarters of the Tavoy district, has a court house, treasury, jail, and hospital, and is connected by telegraph with Moulmein and Bangkok. The main wharf is about 36 miles from Tavoy point. The town lies low, and its north-west and south portions are flooded at high spring tides. It is methodically laid out in straight streets. Population in 1878 about 14,800. Rainfall is heavy, averaging from 190 to 220 inches in a year.

Trade.—Exports are rice, dhaní leaves, jaggery, sugar, earthen pots, wood-oil, timber, and fruits; imports, piece goods, long cloth, turkey red cloth, velvets, iron, crockery, tobacco and dried vegetables. Trade is carried on with the Straits Settlements and Penang during the fine season by native craft, which shelter at Tavoy during the monsoon.

Supplies of various descriptions can be obtained.

Communication by steam vessel takes place weekly with Moulmein and Mergui. Steamers trading with the Straits Settlements call frequently at Tsinbyubyin, where there is a rest house and good road leading to Tavoy.

Hnet thaik taung or Cap islet is 523 feet high, and steep-to except on its eastern side, from whence a shoal spit of $3\frac{1}{2}$ fathoms extends for about 3 cables. The channel between Cap island and the main is clear, has 10 to 12 fathoms, and may be used by steam vessels.

Kiantaung, 1,280 feet high, and 3 miles north-westward of Tavoy point, is covered with forest, but shows a slight clearing when viewed from the east and westward.

Tavoy point or Shin maw, marked by three pagodas, is steep-to, and may be approached without fear. There is good shelter for vessels northward of the small peninsula.

Proserpine rock or Puklaji, 7 cables to the northward of the N.E. extreme of Shin maw, is a dangerous patch, one of the rocky heads of which shows at low-water springs. If a vessel requires to anchor under Shin maw there is sufficient room without nearing Puklaji, and if wishing to pass to the northward of it, where there is good anchorage ground, Button island should be brought on with the west extreme of Reef island N. $\frac{1}{4}$ W., and steered for until Kiantaung, or the centre of the sandy beach under it, bears W. by N.,

or till Fisherman islet bears N.W. $\frac{1}{2}$ W., then haul to the westward, and anchor as convenient. Shoal water extends for half a mile off the south-west point of Reef island.

Gogaligyun (Reef island) is 470 feet high. Clearings of the trees, made for the free passage of the light rays, are conspicuous. Shoals extend to the southward of Reef island for $1\frac{1}{2}$ miles, and it should not be approached from that direction.

LIGHT.—From a concrete tower, 25 feet high, on a hill near the north-east point of Reef island, is shown, at an elevation of 309 feet above high-water, a *fixed white* light, visible in clear weather from N. 6° E. through west, to S. 17° E., from a distance of 12 miles.

Anchorage in 6 fathoms, mud, will be found on the eastern side of Reef island, under the lighthouse, with Whale rocks in line with the left extreme of Tavoy point S.S.W. $\frac{1}{2}$ W. Boats can land on the beach abreast Whale rocks, and a good road extends thence to the lighthouse.

Water is obtainable from a well near the landing place on Reef island, but of inferior quality to that which escapes from under the gravel near high water mark, of which there appears to be a copious supply.

Whale rocks consist of a heap of boulders lying 2 cables off the eastern side of Reef island, and lie S.S.E. 4 cables from the lighthouse. These rocks, which are just covered at high water spring tides should not be approached within a cable; they afford a good indication of the state of the tide to a passing vessel.

Thombongyun (Middle island) is 725 feet high and thickly wooded. It is inhabited during the fishing season from January till April only. Anchorage may be found on the eastern side, half a mile from the shore, northward of Button island.

Satlugyun (Button island) consists of granite boulders with trees on them, the whole 162 feet in height, it is useful as a mark for clearing the rocks in the western channel.

Kathemawgyun (Grindstone island), situated northward of Middle island, is 550 feet high, and densely wooded. At its north-east point is a large granite boulder with a pagoda on it, having deep water close-to; the tide runs strongly past it. The small bay to the northward, between the island and the shore, is shallow. Ships drawing as much as 30 feet can proceed as far as this with safety, and good anchorage in 6 fathoms may be found along the eastern side of the islands, already described, in most parts at a distance of about half a mile from the shore.

Yabaichauk (Mahratta) rock, on which the steam vessel of that name struck in 1875, is a dangerous pinnacle, with 7 feet over it at low water springs, and 22 feet close around, marked by a strong ripple. From it, the east extreme of Grindstone island, with the east extreme of Reef island just outside it, bears S. by E. $\frac{1}{4}$ E., and the east extreme of the point next south of Round hill, S.W. $\frac{3}{4}$ S., $4\frac{1}{2}$ cables.

Rocky ground, with a depth of 18 feet on it, lies 4 cables eastward of Mahratta rock, and the bottom in the locality being generally irregular and hard, vessels should keep on the leading line of the east end of Grindstone island on with the west end of Button island, until they have passed Chaukdaw rock.

Chaukdaw rock, situated 2 cables from the shore, and $3\frac{1}{3}$ miles from Round hill on a N. $\frac{3}{4}$ W. bearing, has 12 feet over it at low water springs. A vessel steering up the river will be clear of Chaukdaw rock when the conspicuous fall on the southern side of Tawantaung hill bears southward of W.S.W.

Pinjigyun or Crab island, low, and thickly covered with trees, is about 30 feet high, and occupies the centre of the river for $6\frac{3}{4}$ miles in a north and south direction. From the southern end, a spit of sand and mud, dry in places, extends southward for $5\frac{1}{2}$ miles, dividing the river into two separate channels. In 1885, a large fish trap in 10 feet at low water, marked the south end of the spit.

Shityangyun (New island), formed during the last 30 years (1885), and joined to Crab island at low water springs, appears to be rapidly extending to the northward. A succession of similar low alluvial islands connected by shoals, stretch up the river as far as Tavoy. Vessels of 12 feet draught cannot advance beyond New island.

DIRECTIONS.* — Entering the river, after rounding Tavoy point, which is steep-to, steer N.E., and do not bring the extremity of that point seen astern southward of S.W. $\frac{1}{2}$ W., until the east extreme of Grindstone island is seen just outside the east extreme of Reef island, bearing N. by W. $\frac{1}{2}$ W. Whale rocks will then be shut in with Reef island, and a vessel will be clear of the shoal ground

* Sailing ships leaving Tavoy or Mergui during the south-west monsoon may find difficulty in obtaining an offing; a favourable opportunity should be embraced in sailing from either place. In bad weather, it will be prudent to work to windward with the anchorage under Tavoy point, or that under Tavoy island, open, until sufficient offing is obtained to weather the islands of the Mergui archipelago if bound south, or of reaching the coast of Pegu westward of Rangoon river if bound north. (Horsburgh, 8th edition).

stretching southward of Reef island. Thence steer N. by W. to pass 2 cables eastward of Whale rocks and Reef island, and alter course to N. by W. $\frac{3}{4}$ W., when Button island bears West. This will lead a cable eastward of the north-east point of Grindstone island, and on to the leading mark, east extreme Grindstone island on with west end of Button island, S. by E. This mark should then be kept on astern until the southern slope of Tawantaung bears W.S.W., when haul over to the western bank of the river and continue along it at a distance of $1\frac{1}{2}$ cables, until just beyond the port tide gauge, where there is an open space, with tank and rest house. Anchorage may be found here in 13 feet, mud, at low water springs.

A vessel not drawing more than 8 feet, and short and handy, should take a pilot at this anchorage, if intending to proceed to Tavoy.

Bound for Tsinbyubyin, on the east bank of the river, and if of 13 feet draught, the state of the tide must be considered for crossing the bar at Elbow point; if detained on this account, a vessel will find good anchorage on the eastern side of Reef island. After leaving Tavoy point, having gained a position with the east extreme of Grindstone island seen just outside the east extreme of Reef island bearing N. by W. $\frac{1}{2}$ W., and Tavoy point bearing S.W. $\frac{1}{2}$ W., a vessel should steer N. $\frac{1}{4}$ E. or for the western extreme of Elbow point, until the north extreme of Middle island bears W. $\frac{3}{4}$ S., when a large fish trap (1885) at the end of the central spit should be in line with that extreme; then steer N. by W. $\frac{3}{4}$ W. or for the left extreme of Crab island, and so continue until the projecting mangrove point next south of Elbow point, bears E. by N. $\frac{3}{4}$ N., when Button island should be just opening to the left of Middle island. Then steer N. by E. $\frac{1}{2}$ E. so as to pass Elbow point at a distance of about 3 cables, and gradually closing to one cable, continue at this distance until the left extreme of New island bears W. by S.; this will be in the anchorage for vessels of 12 feet draught, which extends about 3 cables north of the bungalow, and is a cable broad. The bottom is soft, and the tide runs about 3 knots at half flood.

TIDES.—It is high water, full and change, at Reef island at 10h. 57m., springs rise $15\frac{1}{2}$ feet, neaps rise $10\frac{1}{2}$ feet, neaps range $5\frac{1}{4}$ feet; at Tsinbyubyin it is high water 18 minutes later than at Reef island, springs rise $16\frac{1}{4}$ feet, neaps rise 11 feet, neaps range $6\frac{1}{4}$ feet; at Tavoy it is high water full and change, at 12h. 0m., springs rise 12 feet (approximate).

Above Tsinbyubyin local knowledge is indispensable, as shoals are numerous and the channels continually altering. A launch can

steam from Tsinbyubyin to Tavoy in 2 hours, leaving at half flood, near the springs. In the height of the rains, during neaps, there is no flood stream felt above New island.

Inzaukaiyu rock, which dries 2 feet, is situated close to the right bank, at a place called Biyaungbauk, opposite to Shwegyun, off which runs a sandy shoal. To clear this shoal and mark the rock, two buoys are placed.

Off Tavoy there is no room for anything larger than a cargo boat to swing. The fortnightly steamer arrives at high water, turns, and moors to a pontoon which is secured to the bank.

MERGUI ARCHIPELAGO.*

GENERAL REMARKS.—The islands of the Mergui archipelago extend from Tavoy island, in lat. $13^{\circ} 13' N.$, to Sayer islands in lat. $8^{\circ} 30' N.$, and in some instances lie 70 miles off the mainland. These islands, being high, may be seen from 25 to 40 miles distant. Their west sides generally present lofty perpendicular cliffs to seaward, but on the east, they slope gradually and occasionally have sandy bays. Mangroves grow extensively round the northern islands. The most westerly are composed of granite and porphyry, those nearer the shore of sandstone and conglomerate. They are covered with large trees and thick underwood, yielding excellent timber, the caoutchouc tree being said to grow in great abundance. Tin is known to exist on some islands and coal may possibly be found. Maingy island has abundance of lead ore. A few wandering fishermen (Selungs), who live in their boats, are the only residents of the archipelago. These are an inoffensive uncivilised race, subsisting chiefly on fish, and following agriculture in a rude manner. For rice and clothing they barter sea slugs and forest produce. Malays and a few Chinese visit certain of the islands annually to collect edible bird's nests, found in almost every rocky island. Trepang or Bêche-de-Mer (sea slug) is an object of search, but it is scarce, there being no extensive coral shoals.

On the beaches of several islands the marks of deer and hog were seen, also a footprint, said to be the tiger's, but none of these animals were met by the surveyors. The islands rest on a rocky basis, and on many of the rocks, wholesome oysters abound. There are many small barren rocks amongst the islands of the archipelago, usually with deep water near them.

* See Admiralty charts :—Mergui archipelago, Nos. 216*a*, and 216*b*.

Between Tavoy point and Pakchan river, a distance of nearly 250 miles, there is almost completely sheltered navigation amongst the Mergui islands for steam-vessels and small sailing craft. The usual track (which will be described) was frequented by Chinese junks before Burma became a British possession. For several years steam vessels have navigated these passages.

ROUTES.—The best route for steam vessels from the southward, is eastward of St. Matthew's and Hastings islands, thence through Forrest strait to the northward, passing to the westward of Bushby, and Domel islands. Small vessels pass eastward of Owen, and Domel, islands; but when abreast the middle of Domel island, the passage nearly dries across at low water springs, leaving a narrow creek through sandbanks on the west side near the Domel shore, termed Celerity passage.

Winds and weather.—The north-east monsoon commences in the Mergui archipelago about the middle of October, at which time the wind is east, occasionally blowing fresh. In December, at about noon, the sea-breeze sets in from north-west, veering to north at sunset, and by midnight the wind is from east-north-east or east, at times blowing strong between sunset and 11 a.m. on the following day. By keeping near the islands a sailing vessel will get rapidly to the northward; whereas in the offing, the wind will be found chiefly from north-north-east to north-north-west. The finest weather is from November to February when the north-east monsoon is blowing in the China sea. Owing probably to the narrowing of the Malay peninsula the north-east breezes are stronger in the neighbourhood of Pakchan, and near High island the breeze is often strong in the middle of the day. At that time of the year too the air is clear and all distant peaks are visible making navigation easy. The nights are cold, the thermometer sometimes falling to 65°, and occasionally the north east wind freshens between 10 p.m. and 2 a.m. In March, the sea-breezes amongst the islands set in from the westward, with light winds and calms in the offing, misty weather, and increasing heat. In February and March, light winds have been experienced between Kabosa and cape Negrais, with a weak current setting to the southward. In April the afternoon becomes squally with the wind at east, and much thunder and lightning may be expected amongst the islands.

The south-west or rainy monsoon sets in about the middle of May, after which, the archipelago is subject to squally weather for successive days, and a deluge of rain; the rain lasts till September. The

surveying vessel *Nearchus* was amongst the islands during the whole of the south-west monsoon ; it appears that a sailing vessel may easily work to the southward within the islands, as the *Nearchus* frequently experienced several successive days of fine weather.

Soundings.—The bank of soundings extends for some distance outside most of the islands, but has not yet been thoroughly examined ; near some the water is deep, yet their proximity may easily be known by the lead, if kept going.

CAUTION.—In passing through any of the channels, or inside the islands, a continuous good look-out is necessary, as probably there are more dangers than those shown on the chart.

The channels between the outer islands, are so imperfectly known that it is advisable to warn navigators against adopting any of the central entrance channels from seaward, except *Nearchus* passage in lat. $11^{\circ} 50'$ N., Forrest passage in lat. $11^{\circ} 5'$ N., and Investigator channel in lat. $10^{\circ} 15'$ N. If to the northward of these, it is better only to approach the mainland through Tavoy channel, which lies between $13^{\circ} 20'$ and $13^{\circ} 30'$ N., or, if to the southward, by passing south of Chance island in lat. $9^{\circ} 20'$ N.

TAVOY ISLAND, the north point of which is about 19 miles southward of the pagoda on Tavoy point, is about 18 miles in length north and south ; and its highest part, in about lat. $13^{\circ} 5'$ N., is elevated 2,245 feet. On the south-east side is a pagoda, near to which, good fresh water can be obtained. Though considered fertile, this island has only some houses and a few settled families of Selungs. The caves in the hills of the island are tenanted by the edible-nest-building swallow, and the right of taking the nests, which are exported to China, is leased by the Indian Government. The western side of the island is very steep, and a string of islets and rocks, extends in a S. by E. direction for about 5 miles from its southern point.

Port Owen,* on the north east side of Tavoy island, affords good anchorage, protected from the eastward by Edward, William, Rich, and Campbell islands, which are joined together by a shallow flat which dries at low water. A mud bank of 12 to 20 feet extends south-eastward from these islands, and nearly meeting Fisher peninsula which projects from the east side of Tavoy island, assists to shelter the anchorage. The depth in the harbour is from 7 to 12 fathoms, and in the narrow channel formed by the mud bank and the peninsula, $4\frac{1}{2}$ to 6 fathoms.

* See Admiralty plan of Port Owen No. 835, scale, m = one inch.

Tides.—It is high water, full and change, at port Owen, at 10h. 50m. Springs rise 20 feet. The stream of flood sets fairly to the southward in the direction of the trend of the harbour, at springs, 3 knots. Wood and fresh water are easily obtained.

Tavoy island and the islands just mentioned, are 14 to 16 miles from the mainland. The channel between is navigable, and affords anchorage; eastward of port Owen its width is contracted to less than 5 miles by a bank of 10 to 15 feet, which extends about $6\frac{1}{2}$ miles from the shore of the mainland, and its depth in this part, through which the tide sets with a velocity of $1\frac{1}{2}$ knots at springs, is from 5 to 8 fathoms. The Tavoy islands being high can be made at night. The lead gives warning of too near an approach to the bank off the mainland, towards which a vessel would only be set on a strong flood tide.

Great Canister, a conical island, about 5 miles westward of the southern part of Tavoy island, is 1,084 feet in height. It has an irregular outline, and the depths close to it are unknown. About 3 miles north-east of Great Canister, and between it and Tavoy island, are three high black rocks or islets; also, at about 4 miles south-east of Great Canister is another group of high rocks, the vicinity of which should be avoided.

Little Canister, situated $6\frac{1}{2}$ miles southward of Great Canister, is also a conical islet; it is 990 feet high, covered with trees, and apparently bold and rocky. No soundings have been obtained nearer to it than a distance of $1\frac{1}{2}$ miles.

Kabosa, the northernmost of the outer Mergui islands, has several summits, the south-western, elevated 1,388 feet, being the highest. It is covered with jungle. The approximate position of its centre is lat. $12^{\circ} 48' N.$, long. $97^{\circ} 51\frac{1}{2}' E.$

West Canister is a small, steep, high island, covered with jungle, situated about 8 miles south-west of Kabosa, the channel between being termed Investigator passage; this island resembles Little Canister island in appearance, but its northern end slopes more gradually and is of a snout-like aspect. About $4\frac{1}{2}$ miles eastward of West Canister, is a group of pinnacle rocks, one of which is 30 feet high.

Freak islet, nearly midway between Kabosa and Tenasserim island, is low, with a few scraggy trees on it, and surrounded by rocks.

Tenasserim island, about 10 miles southward of Kabosa island, almost circular in shape, is one of the largest of the outer islands of

the group. It is 3 miles across, and its lofty peaks (about 2,000 feet in height) appear, when viewed from a distance, like two or three islands. Off its north end are Herbert and Howard islands, the latter distant from it about $1\frac{1}{2}$ miles. Off the east and south-west sides of Tenasserim island, distant about a mile, are detached islets of which little is known.

Brown rock, about 8 miles S. by W. $\frac{1}{2}$ W. of Little Canister, is 66 feet high, with rocks which occasionally dry to the north and south of it; it is therefore advisable not to approach it nearer than a distance of 4 miles. A sunken reef has been reported in a position nearly 3 miles westward of Brown rock, but its existence is doubtful.

Thamihla (Iron island) has its summit, 1,023 feet high, near the south end. Off its north point are rocks which dry at low water.

DIRECTIONS.—A vessel having made Kabosa island may pass northward of it, and thence steer either for the channel north of Iron island or for that between Iron and King islands. In the channel north of Iron island there are strong eddies especially during the south-west monsoon.* A strong current also prevails at the same period in the channel south of Iron island.

Tides.—It is high water, full and change, at Kabosa island at about 8h. The set of the tide is irregular; in the channels on either side of Iron island, the flood stream appears to set to the eastward.

Maingy island is situated off the west side of King island, from which it is separated by a narrow channel believed not to be navigable. Maingy island is about 1,800 feet high and is said to have an abundance of lead ore.

KING ISLAND, north-westward of Mergui, is 23 miles long north and south, and averages about 7 miles in breadth. It has a scanty population of Karengs and Burmese, and is rich in alluvial land and fine forest trees. Plantain island or peninsula on its north-east side, forms with its northern point, an anchorage known as King island harbour or sound, where very good water can be obtained.

Deep water runs up in a narrow bight, close to the north-west entrance bluff and the stream will be found half a mile from the bluff,

* In channel north of Iron island found strong eddies and tide rips, the water foaming and whirling so as to slue the ship four points on each side of her course. Did not find the eddies between Iron and King islands anything like so strong.—(Navigating-Lieut. E. O. Hallett, H.M.S. *Cossack*, April 1871.)

where there is a stony beach and a small rocky islet. Boats should go for water at half flood.

Lys shoal, a rocky patch, having over it 11 feet at low water, lies $1\frac{1}{2}$ miles north-eastward of the northern entrance point of King island sound.

Directions.—To pass north-eastward of Lys shoal, Little Canister should be wholly shut in by the south-west extreme of Iron island, until the northern entrance point of the sound bears W.S.W., when the anchorage may be steered for.

Anchorage.—At spring tides a vessel should anchor with the east extreme of the northern entrance point N. by W. half a mile, but at neap tides 16 or 17 feet will be got at low water on the middle bank off the watering place.

A mangrove creek through which canoes can pass, connects the head of King island sound with Fell passage.

Tides.—It is high water, full and change, at King island sound at 10h. 45m., and the rise of tide is from 12 to 16 feet.

MERGUI HARBOUR* is formed between the west coast of an island of the same name at the mouth of the Tenasserim river, and Madramakan island, generally known as Pataw, which latter gives its name to a conspicuous hill at its northern end, 785 feet high. Madramakan island is 2 miles long north and south, by about three quarters of a mile in breadth. At its southern end is a hill called Patitaung 264 feet high.

The town of Mergui (population in 1886, 8,870) is the most important in the southern province of Burma, and the head-quarters of a Deputy Commissioner. A considerable number of Chinese emigrants are here settled, and trade is carried on with Rangoon, Tavoy, Singapore, and Penang, by both steam and sailing vessels; the British India Steam Navigation Company calling monthly. The mails arrive once a fortnight. The telegraph has not been extended to Mergui. No large repairs to vessels can be executed. There are no regular pilots for the harbour. The climate though warm and humid is considered healthy.

Trade.—The chief exports are tin, timber, spices, rice, drugs and hides, value Rs. 600,000. The chief imports, silk, cotton, piece goods, tobacco and oils, total Rs. 475,000.

* See Admiralty plans:—Approaches to Mergui harbour, No. 1075; scale, $m =$ one inch; and Mergui harbour, No. 218; scale, $m = 4$ inches.

In the perigee springs of February or March the tide may fall a foot lower than the datum to which the soundings on these charts are reduced.

There is a hospital into which seamen are admitted, an entrance fee being paid by the master of the vessel; Rs. 15 for vessels under 300 tons, and Rs. 25, below 1,000 tons.

Water.—The best fresh water for a ship is from the waterfall near the north point of Madramakan island, obtainable at high water; that from the wells of Mergui is of poor quality.

INNER ROUTE TO MERGUI for steam vessels from the northern ports of Burma, is to pass eastward of Tavoy island, keeping about 2 or not more than 3 miles from it, in order to avoid the shoal water which extends 6 miles off the mainland. Canister bank, 575 feet high and rounded, and Long island, also high, on the eastern side of the fair channel, are excellent marks, and so are Iron island, Great and Little Canisters to the west, and King and Plantain islands to the south, by the bearings of which, a vessel's position can be readily determined.

Amyinpoma islands, eastward of the south end of Tavoy island, are a pair of small islands lying close together in a north-west and south-east direction. The northern is of conical shape, 529 feet high, the southern is 370 feet in height.

Bowers reef, a rocky patch, half a cable in extent, and drying at two thirds ebb, lies $1\frac{1}{2}$ miles south-westward of the southern Amyinpoma island.

Long island, southward of Amyinpoma islands, is 457 feet high and narrow, appearing round from the northward and southward; there is foul ground 6 cables off its west side. Cone island is a small conical islet 138 feet high, lying three-quarters of a mile E.S.E. of Long island, and has foul ground south-west of it.

Three quarters of a mile N.E. from Cone island is another group of rocks, 35 feet high.

Kawdwé rocks, a small patch of rocks just above water, lie $2\frac{1}{2}$ miles south of Long island, and mark the eastern limit of the channel.

Pyinban islet, 82 feet high, lies $3\frac{1}{2}$ miles S.E. from Long island. It is bare and from it a chain of islets and rocks extends southward for $7\frac{1}{2}$ miles to Barn island. From 1 to 2 miles eastward of this group, there is another and higher chain of islands, 2 to 4 miles from the mainland, which appears high from the channel.

Barn island is a square precipitous rock, 86 feet high. Cap rock, 22 feet high and small in extent, lies $1\frac{1}{3}$ miles N.W. $\frac{3}{4}$ W. from Barn island.

The western sandbank off the Kiaupi river, lies S.S.W., nearly 3 miles from Barn island. It has 5 feet over it at low water spring tides, and is close to the channel leading to Mergui.

Beacons.—Two beacons, one on the east and the other on the west side, mark the entrance to the channel to Mergui, north-westward of Kalwin point.

DIRECTIONS, from the northward.—King, Plantain and Iron islands, show as one lofty island from the northward. When Long island is abeam steer for the left extreme of Plantain island, which is steep, on a S. by E. bearing. When Barn island bears E.S.E. steer for Madramakan or Pataw peak, keeping it S.S.E. $\frac{3}{4}$ E. until the north-east extreme of Plantain island almost touches the south-west extreme of Iron island, N.W. $\frac{1}{2}$ W., which mark kept on astern leads direct to the anchorage 2 miles N.W. by W. of Kalwin point.

For Mergui harbour.—No stranger should attempt to enter until after the first quarter flood if of 10 feet draught, or till after half flood if drawing more than 10 feet. At neaps, with local knowledge, a vessel of 15 feet draught may enter after first quarter flood. Steer to pass midway between the beacons north-westward of Kalwin point, and then shape course S.S.E. $\frac{3}{8}$ E., with a white-washed basket on the mangroves about one mile north of the town, in line with a white-washed pagoda on the hill behind the town,* until the left extreme of the Commissioner's house, bearing S. $\frac{7}{8}$ E., comes nearly in line with the right extreme of the market (conspicuous white shed near the water's edge). From this position, which is $2\frac{1}{2}$ cables from the mangroves on Mergui island, steer for the Commissioner's house until the right extreme of Madramakan island bears W. by N. $\frac{1}{4}$ N.; the left extreme of the trees on Kalwin point should now be kept astern bearing North a little easterly, this course taking the vessel 2 to $2\frac{1}{4}$ cables off the Mergui island shore, or steer to pass one cable west of the extreme of the main wharf, and anchor $1\frac{1}{2}$ cables W.S.W. or W.N.W. from it. These directions reversed will guide a steam vessel in leaving.

A spit with 14 feet over it extends west of the end of the main wharf for $1\frac{1}{2}$ cables. By anchoring as recommended, this spit will be avoided, and vessels drawing not more than 15 feet, or more than 200 feet in length, will have swinging room at low water.

* This pagoda is small and not easily distinguished, the most conspicuous pagoda is about half a mile south-westward of the first, near the Commissioner's house.

Rocks, low and shelving, extend about $1\frac{1}{4}$ cables from Madra makan island opposite to the main wharf, and under a small pagoda on a low hill. Several detached heads exist, and curtail the anchorage space, one of them drying $3\frac{1}{2}$ feet at low water springs.

Tides.—It is high water, full and change, at Mergui at 11h. 9m. Mean springs rise 18 feet, and neaps 11 feet. Mean neaps range $4\frac{1}{2}$ feet. The tidal stream at half tide, at springs, runs about 2 knots during the dry season, the ebb is probably increased during the rains. The set of the flood stream between Long island and Fell passage, is to the southward.

Climate.—The following Table is from observations taken at Mergui, at an elevation of 96 feet above sea level :—

Month.	Temperature.					Humidity.	Cloud.	Rainfall.		Barometer.	
	Mean.	Mean Max.	Mean Min.	Mean Range				Inches.	Days.	Mean.	Daily Range
				Daily.	Month						
January - -	77	89	68	21	30	73	2·7	0·5	2	29·87	·11
February - -	79	90	71	19	26	75	3·1	1·4	3	—86	·12
March - -	80	92	73	19	25	77	3·8	2·3	6	—83	·12
April - -	81	92	74	18	24	79	5·4	5·7	8	—78	·12
May - -	80	90	75	15	23	83	7·3	15·9	16	—75	·10
June - -	77	85	73	12	20	89	9·1	29·8	25	—74	·09
July - -	76	84	73	11	18	89	9·0	31·6	28	—74	·08
August - -	77	84	73	11	18	90	8·7	28·1	26	—75	·09
September - -	77	85	73	12	17	90	8·7	26·3	25	—78	·10
October - -	78	87	73	14	19	86	7·3	13·5	20	—80	·11
November - -	77	87	71	16	24	80	5·3	3·5	7	—82	·11
December - -	76	88	69	19	27	74	2·8	0·5	2	—85	·10

South approach to Mergui.—The islands in the south approach to Mergui harbour are—

Thetyagi, a group of 4 islets, lying about $2\frac{1}{2}$ miles, eastward of the south end of Burnett island (near the south point of King island), the northern of which is rounded and has a small sand beach on it. A rocky ledge extends to the north-westward for 3 cables from the northern islet, and should be given a wide berth.

Pyin island, $2\frac{1}{4}$ miles to the northward of Thetyagi group, stands on a mud flat joining Bertie island (which is all low mangroves, except a wooded hill at its south-east point) to Burnett island.

Thetyangai or Balu is bold and has a small summit at its south-west end, nearly detached from the rest of the island. The mud dries out all round this island at low water.

Maragi (Merghi) islands, southward of Burnett island, are bold and lofty; the highest summit, 1,646 feet high and in shape pyramidal, is on the south-west island. The Maragi islands are useful in Fell passage, as leading marks. A shelving mud bank extends from their western sides, having over it only 3 fathoms at $1\frac{3}{4}$ miles from the shore.

Two round islands lie off the south end of Burnett island; the bottom appears foul between them and the Maragi islands. A patch drying 9 feet shows at half tide, $1\frac{1}{4}$ miles East of the south end of the northern round island.

The channel into the south entrance to Mergui, passes between the northern of these two islands and Burnett island.

Limlor or Arabann island, 204 feet high, stands on the south-east corner of the mud flat off Bertie island, and opposite to the channel leading into the southern entrance of Tenasserim river, named Kwanthaung Wa. Good anchorage in 7 to 8 fathoms may be had immediately south of this island.

Letsari islands, eastward of Bertie island, are both small and thickly wooded, the southern islet being twice the height of the other.

From South Letsari island which is conspicuous, a mud flat extends southward to within 2 cables of Falle island, which is the northern of several haycock shaped islets. This mud flat forms the boundary edge of the southern entrance into Mergui and the northern boundary of what appears to be a deep channel into Tenasserim river.

DIRECTIONS, from the southward :—The south entrance to Mergui saves a detour of some 15 miles, to ships coming up the coast. It is however very shallow for 10 miles out from Mergui, there being only a foot or two of water at low-water springs. Vessels drawing 8 feet can use it at high water, and if the banks were marked vessels of 12 feet draught.

When the south end of Cantor's island (situated 8 miles south-westward of the south end of King island), bears N.W. distant 2 miles, steer for the south end of Burnett island N.E., and when

Shrub rock bears North, distant three quarters of a mile, alter course to pass midway between the south end of Burnett island and the northern of the Round islands, remembering that at springs the tides are strong in this vicinity. Then steer N.E. $\frac{3}{4}$ N. for $3\frac{1}{2}$ miles until the eastern extreme of Pyin island bears N. by E., when alter course to pass $2\frac{1}{2}$ cables from the south end of Arabann island; when the south extreme of this island bears West, steer N.E. by N. for Pataw hill, which is easily recognised, being the highest land opening out on that bearing, after rounding Arabann island. This channel is marked by fish traps on either hand and the course takes a vessel midway between them.

Above North Letsari island, the mud flats extending off Kan bi sat and Thitya islands nearly join, although there is a narrow channel between the islands, carrying 12 feet at high water neaps. The fishing stakes show the channel, and by keeping towards those on the Kan bi sat side, a vessel may pick her way across the flat.

The Kan bi sat mud flat has more water over it than the one on the opposite side. When off the centre of the entrance to Kan bi sat creek and with it bearing East, steer for the summit of Kalé island on a N.N.W. course until just past the fish trap, when Pataw hill pagoda will bear N.E. by E. $\frac{3}{4}$ E., then steer for the north end of Pataw island to pass between the sand spit projecting $1\frac{1}{4}$ miles from the mangroves on the north-west side of Kanan island, and a patch of rocks named the Greenwich reef, that dries at half tide, lying nearly $1\frac{3}{4}$ miles S. by E. of Kalé island. When past the sand spit, steer towards the south point of Pataw island, rounding it at a distance of $1\frac{1}{2}$ cables, thence for the anchorage off the main wharf.

TENASSERIM, a town on a neck of land at the confluence of the Great and Little Tenasserim rivers, 33 miles south-east of Mergui, is built on red sandstone rock along the slopes of a hill, amidst mountainous country. No traces of ancient greatness remain, and a few miles below the town, a reef of rock stretches across the river, over which, even during the rains, no vessel drawing more than 6 feet can pass. In 1877, Tenasserim had dwindled down to a village of 666 inhabitants. The temperature is variable, and climate considered unhealthy.

TENASSERIM RIVER has several mouths, the two principal of which are separated by Mergui island. Large boats can ascend as far as Tenasserim town. The banks of the river are in places very steep, and the channel is in parts narrow. The tide is felt 10 miles above Tenasserim town.

NAVIGATION BETWEEN MERGUI AND JUNKSEYLON.

FELL PASSAGE,* used by vessels proceeding to the southward through the archipelago, lies along the east side of King island; it is 19 miles in length and has a least depth of $2\frac{1}{2}$ fathoms at low water. In the centre however there is a narrow pass, in which it is difficult to avoid passing over $1\frac{1}{2}$ fathoms at low water. The channel is narrow and runs through the mud banks that lie between all the islands, but with a rising tide and attention to these directions, it is by no means difficult. At high water neaps, there is not less than 21 feet throughout its length.

Sa island, 322 feet high, is a steep islet lying close to the southward of the east bluff of Plantain island, and marks the north end of Fell passage. A stony shoal trending northward from Kala gyun has its apex half a mile East of the north end of this island. Sa island should therefore be approached on a S.S.W. bearing, until within 2 cables, at which distance it should be passed on its east side, and a S. by W. course steered to pass in mid channel between Kala and King islands. After passing the western elbow of Kala gyun keep rather over to that island until the channel between Yemyok gyun and King island opens, when gradually haul into the channel, keeping now to the western shore to avoid some lumps of $1\frac{1}{2}$ fathoms, in mid-stream.

Yemyok gyun is covered with mangroves and has a spit that dries 3 cables off its north end. Keeping to the western shore, a large double creek that does not dry, will soon be passed, and a small round wooded islet (Sakoné gyun) will be seen opening to the westward of Yemyok gyun. Altering course gradually bring Sakoné gyun to about twice its own breadth open eastward of Bare island, which has a rounded bare summit; but on no account let them close altogether, and running down with Sakoné thus bearing, S. $\frac{1}{4}$ W., pass Bare island at one cable's distance, and then keep S.S.W. for the Paye gyun passage.

Pigalé, another small islet, will now be seen ahead, a passage exists either side of it. Short vessels prefer the eastern channel which is narrower but more direct, and easier when going to the southward. Rocky spits project from Pigalé islet to eastward and north-north-westward.

A pole, surmounted by a basket, marks the eastern end of the rocky spit stretching eastward from Pigalé.

* See Admiralty plan :—Approaches to Mergui harbour, No. 1075.

Pigalé passage.—Going south, keep the east side of Bare island touching the west side of Yemyok gyun, until the north end of Paye gyun island is abeam, when starboard sufficiently to open the above islands apart. When the north end of the small islet bears W. by S. $\frac{1}{2}$ S., keep in mid-channel going through, leaving the above beacon on the starboard hand.

Going northward, round the north-east part of Thanpo island, (south-westward of Pigalé), at $1\frac{1}{2}$ cables distance, to avoid a shelving gravel bank off it, and steer for its north point, which is rocky, bearing N.W. by W., until the east side of Myi ni which is next north of Thanpo island, is nearly in line with the bare summit of Bare island, when haul to the northward, and skirting the island on the port hand, stand out N.E. by E. into the direct channel again. The shoal of $1\frac{1}{2}$ fathoms in this channel is composed of gravel.

Continuing to the southward, the track leads to the opening between King island and the islands off it, passing Thanpo island and the spit south of it, at $1\frac{1}{2}$ cables distance, and Gyun thaung which has been partly cleared, at 2 cables. A shoal of sand and shells, lies in mid-channel, half a mile S.W. from the western extreme of Gyun thaung, and has only $2\frac{1}{4}$ fathoms over it; it can be avoided by borrowing on the western side.

The track now leads midway between King island, and Burnett, Fell and Passage islands. Between the first named the eddies at springs are strong.

The south end of King island, terminates in a bay, between the headlands of which the water shoals rapidly.

Water can be procured on King island, opposite the north end of Fell island, but the mouth of the stream is not easily distinguished.

Burnett and Fell islands.—Burnett island is low and irregular compared with Fell island, which is 797 feet high and has two summits, the western of which is the higher. Fell island is frequently visible from the passage and provides useful leading marks.

The Lah chi islets, a group of five, lying to the south of this island, are of conical shape and moderate height, the northern islet being the highest.

Passage island, which is south-westward of Fell island, is 370 feet high, and has a nearly level summit with a slight saddle in the centre. A mud bank of $2\frac{1}{2}$ to 3 fathoms extends westward from it.

Tides.—In Fell passage the flood enters at both ends, meeting at about Ngathok, where it takes an easterly direction through the

creek between Kala gyun and Mai aing islands. Between Passage and Christmas islands the general set of the flood stream is easterly. In the vicinity of Shrub rock, the indraught of the flood is very strong at springs, towards the dangers lying on the eastern side. The diurnal inequality is large, the tide lagging at neaps for 2 hours and gradually lessening to half an hour towards springs. Inside Fell passage it is high water, full and change, at the same time as at Mergui.

BENTINCK ROUTE.—Pass 5 cables north-westward of Passage island, and bring the south point of King island in line with the sharp peak of Maingy island N.N.W. Then steer S.S.E. keeping this mark on, and pass one mile westward of Shrub rock. When Shrub rock, 23 feet high with a single bush on it, bears N.E., steer S.W. until the south extreme of Cantor island bears N.W. about $1\frac{1}{2}$ miles distant, and Mouse islet (173 feet) is in line with the sharp peak of Polly island. Then alter course to S.W. $\frac{1}{2}$ S. to pass about a mile to the north-west of Christmas island.

The double peak on the south end of Ross island, kept well open of the south extreme of Cantor island, leads southward of the shoals extending to the eastward of the latter. Small vessels may cross the banks by keeping the east side of Passage island open of Fell island, seeing daylight between them.

In passing between Cantor island and Hext rock care must be taken that the vessel is not set to the southward.

See page 388 for continuation of directions.

Polly island, westward of the south end of King island, has a conspicuous peak 727 feet high, which in line with the summit of Cantor island leads westward of Hext rock.

Hext rock, $2\frac{1}{2}$ cables in extent, has $1\frac{1}{2}$ feet over it at low water springs and is generally indicated by a ripple. From the rock the south point of Cantor island bears N. by W. $\frac{1}{4}$ W. $4\frac{1}{2}$ miles.

Cantor island, somewhat low and irregular, is $1\frac{1}{2}$ miles long north and south; a rock having only 6 feet over it at low water springs, lies $1\frac{1}{2}$ miles E.N.E. of its south point. There is foul ground between this rock and the island.

Bound island, $2\frac{1}{2}$ miles north-eastward of Cantor island, is 203 feet high and rounded. Mouse islet, small, conical and 173 feet high, lies one mile West, and a rock above water $1\frac{1}{2}$ miles S.W. of Bound island.

Medina patches,* lying one mile eastward of Bound island, are composed of gravel and have only $1\frac{1}{2}$ fathoms over them at low water. The shoal is altogether 8 cables long N.W. and S.E., and lies on a bank of 4 fathoms, sand and mud.

ROSS island presents no remarkable features except the double summit at its south-east point.

Water.—Very good water can be obtained in boats at half tide, at Waterfall cove, which lies one mile W.S.W. from the north end of Helfer island, south-east side of Ross island. Boats at half tide can lie underneath the water, which falls into the sea.

Christmas island, southward of Ross island, consists of 3 islets and several patches of rock. The summit, 466 feet high, is on the western islet, which may be passed on its west side at a distance of half a mile. To the north-east and south-east several patches of shoal soundings have been found.

Single rock, a boulder 10 feet above water, lies $2\frac{3}{4}$ miles N.E. by E. from the north extreme of Christmas island, and must be guarded against if steering southward by night on a flood tide.

Tides.—It is high water, full and change, at Christmas island at 10h. 29m., extraordinary springs rise 16 feet.

THE COAST, southward of Mergui, is low and swampy in places. Several rivers, navigable only by boats, find their way to the sea through narrow channels bounded by flats. The elevated ridges or hummocks are generally covered with large trees, many of these formerly appear to have been islands, which have become united by the soil brought down by the rivers.

Auckland bay.—The north end of Selore island, which is 13 miles S.S.E. from the south end of King island, forms, with the land to the eastward, Auckland bay, well sheltered, and having anchorage over it in from 4 to 12 fathoms, mud. Auckland bay is not readily accessible to strangers, and is rarely entered without the aid of a native pilot.

DIRECTIONS. Christmas island to Forrest strait.—With the exception of the vicinity of West Passage island there is, as far as is at present known, deep water between Christmas island and Forrest strait, but as the channels have only been partially examined caution is requisite and the lead should be kept going. After passing one mile west of Christmas island steer S. $\frac{1}{2}$ E. for $10\frac{1}{2}$ miles so as to pass from 2 to 3 cables east of West Passage island.

* Reported by Mr. E. C. Russell, master of the steamship *Medina*.

This course leads $2\frac{1}{4}$ miles east of Warning rock and nearly $2\frac{3}{4}$ miles west of another sunken reef in the same latitude, and care must be taken to allow for the tides which here set N.E. and S.W., the lead being of little use owing to the depth. When passing West Passage island if the water shoals dangerously keep more to the westward where it is deepest; pass South Passage island at three-quarters of a mile. Then steer S. $\frac{1}{2}$ W. to pass the south-east point of Bentinck island at one mile distant, after which bring that point to touch the west side of South Passage island, N. $\frac{1}{4}$ E. From here Bushby island, High Peaked island, and the Five Sisters group become visible.

Keep Bluff point (Bentinck island) touching South Passage island (which leads one mile westward of Fly rock) until past that danger, and then steer a middle course between the rocks off the Five Sisters group and the conical rock off Bushby island, after which steer S.S.E. $\frac{5}{8}$ E. to pass 4 miles east of Father and Son, and $2\frac{1}{2}$ miles west of High island. Care must be taken to allow for the strong tidal streams near Bushby island. If passing Fly rock on passage north keep the Father and Son well open westward of the conical rock off Bushby, or the whole of the conical rock open West of Bushby island will also lead westward of it; South Passage island being difficult to distinguish when approached from the southward. There is deep water marked on the chart east of Fly rock, but the usual track leads to westward of it and should be followed.

For description of islands and rocks around Bentinck island, *see* pages 391, &c.

ANCHORAGES.—During the dark rainy nights which occur in the south-west monsoon, a steam vessel from the northward might conveniently anchor 2 miles to leeward of Bentinck island in 6 or 7 fathoms and equidistant from South and West Passage islands. Advantage may, on similar occasions, be taken of the good anchorage in Forrest strait to leeward of Sullivan, and S.S.W. of High islands, where there are depths of 8 or 9 fathoms.

OUTER OR WESTERN ISLANDS, of the Mergui archipelago, extend about 60 miles from Tenasserim island (described at page 377), between the bearings of S. $\frac{1}{2}$ W. and S.S.W. They are generally of similar appearance, high, steep, and covered with dense foliage, but until properly surveyed, the channels between them cannot be pronounced free from dangers.

Oubliée rocks, one about 12 feet high and the other awash, about a mile apart, north-west and south-east, lie nearly $2\frac{1}{2}$ miles

northward of the north-west point of Elphinstone island, and 3 to 4 miles N.E. by E. of Saddle island, with 15 fathoms between them and Elphinstone island.

Great Western Torres islands form the westernmost group of the Mergui archipelago. The two larger islands are separated by a channel, which is one cable broad at the south end, and 3 cables across at its northern entrance, with depths from 17 to 35 fathoms, except at its narrowest part, where it shoals to 7 fathoms, coral and sand. At this point the fringing reef on either shore narrows the passage to 50 or 60 yards. Half way through, there is a deep cove running back about 3 cables into the western island, with depths from 17 fathoms off the mouth, to 7 fathoms near the head, which is filled with sand. Coral fringes both sides of the cove, but a short vessel in need of repairs or fresh water can moor within it, the fresh water always running at the head. Longer vessels can anchor off the cove in 15 to 18 fathoms, but the holding ground is indifferent and the anchorage exposed to the swell.

To enter.—Bring the channel between the islands to bear S.E. $\frac{1}{2}$ E., when the N.E. Little Torres island will be visible through it; steer in, keeping the island in sight until the cove opens on the starboard hand, when anchor where suitable.

Tides.—It is high water full and change in this cove at 10h. 19m.

Little Torres islands are a group of four islets, averaging 270 feet in height. The south-west islet is double, and has a needle-shaped rock off it. They should not be approached within 3 miles.

Tower rocks on the north point of Prinsep island are an excellent landmark, visible 20 miles on a clear day, but Sargent island being higher than Prinsep island, may perhaps render them indistinct when viewed from the north-westward. These islands lie north-eastward of Great Torres island.

Sir John Hayes island, southward of Sargent island, is nearly 1,600 feet high, and has Fletcher island, 840 feet high at its south end. Deep water has been found close to the eastern shore of Sir John Hayes island.

NEARCHUS PASSAGE.—To enter the archipelago in this latitude, the passage recommended is that between Great Western Torres and Sir John Hayes island, and thence to the northward of Bentinck island.

Pass 2 miles north of Great Western Torres and $1\frac{1}{4}$ miles south of Fletcher island, then stand for the passage between Courts island

and Bentinck island. From this direction the summit of Courts island appears as a volcanic cone and the peak on Bentinck island is not conspicuous. On nearing Courts island keep somewhat over towards it, and thence ~~steer~~ N.E. for Christmas island, passing 3 miles north-westward of Warning rock, which only dries at half tide at springs.

A black rock, seen 8 miles, lies about $16\frac{1}{2}$ miles S.E. by S. of Little Torres islands, or in about lat. $11^{\circ} 23' N.$, long. $97^{\circ} 40' E.$

Nearchus rock, awash at high water, is situated nearly 14 miles E.S.E. of Fletcher island, and $8\frac{1}{2}$ miles from the western coast of Bentinck island; around it are depths of from 31 to 35 fathoms.

BENTINCK ISLAND (Bazangu) north point is in lat. $11^{\circ} 52' N.$ The whole island is hilly, and there are many high summits, but the most conspicuous is a summit 1,012 feet high near its northern end, which shows like a horn when seen on a north-easterly or south-westerly bearing. The north-east arm of Bentinck island is really a separate island, having a narrow gut of water about 2 fathoms deep separating it from the main island and leading through into the northern bay, which has been only partly examined.

The western coast of Bentinck is steep and iron bound, with several islets off it; but on the east coast, which is much indented, there is smooth water and good anchorage, especially between the Passage islands. Daphne rock, awash at low water, lies about $4\frac{1}{2}$ miles to the northward from the south extreme of the east coast, and half-a-mile E. $\frac{3}{4}$ S. from the mouth of a small creek. Several rocks, one of which is perforated, lie off the south end of Bentinck island; the southern rock is about 10 feet high and lies $2\frac{1}{2}$ miles S.W. by W. from the south-east point.

West Passage island and South Passage island, on the north-east side of Bentinck island, are 445 and 364 feet high respectively; bold wooded islands with their ridges trending N.E. and S.W. They are both steep-to on their eastern sides and foul off their western sides. The northern of the two, West Passage island, marks the western side of the channel leading south from Christmas island.

DANGERS. Warning rock.—Several dangerous rocks lie north-westward of West Passage island; of these, Warning rock, which dries at half tide, is the nearest to the track and bears N.N.W. $\frac{1}{2}$ W. distant $4\frac{3}{4}$ miles from the east point of that island.

Peterson rock dries 6 feet at low water springs, and bears W.N.W. $1\frac{1}{2}$ miles from the east point of West Passage island.

Elephant island, comparatively low, (140 feet) appears flat topped from a distance but is really very peculiarly shaped. It marks the eastern side of the channel abreast West Passage island. A single rock, Cap and Feathers, 34 feet high, stands half a mile N.W. of it and must be given a berth of at least 3 cables.

DOMEL ISLAND, about 8 miles eastward of Bentinck island is 23 miles in length in a N. by E. and S. by W. direction, with an average breadth of 4 miles. It is mountainous; the summit about 2,240 feet high, and distant 10 miles from the southern end, being visible at a considerable distance from seaward. Off the north end, extending in a northerly direction, are Money, Trotter, and Parker islands, besides numerous small islets and rocks.

High Peaked island, 956 feet, shows up well from the northward and north-westward, being conical from that direction. Off the north end of High Peaked island is a cliffy islet and two rocks. The northernmost rock is 40 feet high, and is called Fly island to distinguish it from Fly rock, a sunken danger, described below.

Fly rock, a dangerous pinnacle, which is just awash at low water spring tides, and is only a few yards in extent, is composed of rock covered with an encrusting coral. It is perfectly steep to on all sides, and cannot be seen at ordinary low water. From it, the west extreme of Bushby island bears South, 6 miles; and Fly island, S.E. by E.

Bushby island (Buza) is bold, having many similar wooded summits about 900 to 1,000 feet high. Its north coast is indented and has a village in one of its bays. A good watering place will be found at a small sandy cove at the north-west point of Bushby island, anchorage being available in 8 fathoms just outside a line joining the points of the cove. Many wild pigs were seen at the stream. A conical islet or rock 200 feet high lies close off its western coast.

The Five Sister Group, consisting of five small islands and about fifteen rocks of various sizes, are mostly bare and are probably uninhabited. The rocks on the east side of the group are not easily seen in the dusk, one of them being only 10 feet high.

Kisseraing island, eastward of Domel, is a large island 18 miles long and 10 miles broad, and considered one of the most fertile of the Mergui archipelago. The channel on its west side is shallow and narrow, and that on the east side is almost dry at low water.

Whale bay, between the south-east side of Kisseraing island and the coast, is a spacious anchorage, the approach to which is from the south-west. The survey of 1828 shows anchorage in from 6 to 8 fathoms in the eastern part of Whale bay, but the approaches have only been partially examined and should be cautiously navigated. A colony of Malays was established (1832) at Cheding on the south-east side of Whale bay, at that time the only village on the coast for many miles.

Lenya river enters the head or north-east part of Whale bay, and is said to flow through a fertile country; coal was reported to be found 30 miles from the sea.

Bokpyin creek, in lat. $11^{\circ} 17'$ N., dry at low water, flows through a fertile, but thinly peopled country. Southward of it, distant about 10 miles, is an extensive group of islands, with shallow channels separating them, of which but little is known. From thence southward, high land borders the sea as far southward as Pakchan river.

Son and Father are two barren rocky islets, of which Father is the highest (596 feet), distant 8 miles S.S.E. $\frac{3}{4}$ E. from Charlotte, the south island of the Five Sisters. Some rocks above water lie about a mile N.N.W. of them, and there is also a group of rocks above water between them and the Sisters, at about $2\frac{1}{2}$ miles from the latter.

Forrest passage, between Father and Son islets and Sullivan island, is about 22 miles wide and affords an approach to Forrest strait from the westward. Overfalls are met with in Forrest passage indicating a change in the nature of the bottom. The tidal streams set, flood to the east and ebb to the west, about $2\frac{1}{2}$ knots at springs.

Clara island, westward of Sullivan island, is about 5 miles in extent N.N.E. and S.S.W., has a sharp peak to the southward, and tapers to a point at its south end, southward of which, distant nearly a mile, is a small but high islet, called South Sentinel. The highest or northern part of South Sentinel island, is about 1,700 feet above the sea.

North Sentinel, a small islet having a rock near its south-west side, bears about N.E. $\frac{3}{4}$ N. distant $1\frac{1}{4}$ miles from the north-east point of Clara island.

FORREST STRAIT.—High island, 1,392 feet, a lofty double peak, is easily recognised from northward or southward

as it stands alone. The track lies 2 miles west of it (where there are overfalls and eddies probably made by the tide over an irregular bottom) and passes through discoloured patches. A rocky ledge dries out 2 cables from the large sandy beach on the east side of High island, and to the northward of this there is a cove where fresh water can be obtained; but a kedge is required for anchoring close in as the depth is over 15 fathoms.

The shoal reported as lying with High island bearing about S.S.W., distant about 3 miles, was searched for without success. Overfalls and tide rips were however numerous northward of the island. This shoal has been removed from the Admiralty charts.

Sullivan or Lampi island.—Sullivan East Foreland has a low white cliff on it which shows up in the morning sun. Another bold promontory projects $2\frac{1}{2}$ miles south of East Foreland, but is not so conspicuous. At the north end of Sullivan island but close to it, are several small islands; Two Hill island and Olive island appear to have deep water off them, but the Dolphin islands, which are low, with conspicuous trees upon them, have a bank extending $1\frac{1}{4}$ miles east of their southern extreme.

There are also several islands off the west side of Sullivan island sheltering an anchorage where vessels can ride in 6 to 4 fathoms, but it is not much visited and has only been partially examined. There is an excellent stream of fresh water here at all times of the year. A large white rock is in front of the watering place. A pearl bank of some extent has been reported off this side of the island.

Off the south end of Sullivan island are Eyles island, 774 feet and Steep island 426 feet; and $1\frac{1}{4}$ miles east of the latter is Steep shoal, a narrow rocky shoal of 5 feet at low water which can be avoided by keeping High island summit open to the right of the Foreland, bearing N. $\frac{1}{4}$ W.

Half Moon reef, lying $3\frac{1}{2}$ miles N. $\frac{1}{2}$ W. from the extreme of East Foreland, dries 2 feet at low water springs, and is about 2 cables in extent and $1\frac{1}{2}$ miles off shore. The summit of Olive island open east of the Dolphins, leads to north-eastward of Half Moon reef; and the bold promontory seen outside the Foreland leads to the south-eastward.

The Gregorys.—Off the south end of Sullivan island and in the middle of the strait are the Gregorys, five low level tree islands on flat rocky bases covered with sand. The northernmost (Crichton or Bogwo) is 18 miles S. by E. from High island and is a mere wooded cay. From it, shoal water extends $1\frac{1}{2}$ miles to the northward

terminating in a coral patch of 4 feet called Marble patch.* Ordinary care should keep a vessel clear of this patch, as it is in neither channel. Boyut, the Southern Gregory, has a shoal ridge extending to S.W. of it, and should not be approached from any direction within $1\frac{1}{2}$ miles. All the islands of this group have rocky ledges projecting from them and no attempt should be made to pass between them. They are uninhabited but are visited by wood-cutters. The Nicobar pigeon has made a home there, also flying foxes, tree crabs, and the Monitor lizard.

Tides.—It is high water, full and change, at the Gregorys at 10h. 20m. Springs rise 14 feet; neaps rise 10 feet. In the winter night tides are higher than day tides. In the summer months when there is more water in the bay of Bengal the tides do not fall so low as in the winter.

Tidal streams.—Near High island the flood and ebb streams run nearly East and West.

In the channels on either side of the Gregorys flood sets to N.N.E., ebb sets to S.S.W.

Kurrachee rock, nearly 2 miles E. by S. $\frac{3}{4}$ S. from the south extreme of the largest Gregory, dries 5 feet at springs, and can be avoided by keeping eastward of it in soundings of less than 10 fathoms. The rock with less than 6 feet on it, said to lie S. by W. $\frac{1}{4}$ W. nearly one mile from Kurrachee rock, was not found during the survey.

The eastern side of Forrest strait is formed by the main coast of Tenasserim, which although high some distance inland, is, near the shore low and without any conspicuous marks. Boyce hill (806 feet) will, however, be known by its being the only hill near the shore. A mud bank lies off this shore, and close in there are several rocks showing at low water. Off the north end of the Boyce headland, called Kanmau by the Burmese, are several small islets.

Canister rock, the northern of these, is 87 feet high, but small with steep sides, and it is $12\frac{1}{2}$ miles from High island. A rock, which dries 4 feet at low water springs, lies a quarter of a mile north of Canister rock.

Campbell reef, 2 cables long by $1\frac{1}{2}$ cables wide, is a flat stony reef that covers at high water. It lies $3\frac{1}{2}$ miles S. $\frac{1}{4}$ E. from Canister

* Marble rock, reported to lie with northern Gregory island bearing S.S.E. $\frac{1}{4}$ E., distant $2\frac{1}{2}$ miles, was searched for without success, drags being extensively used. It has consequently been removed from the Admiralty charts.

rock, and forms the north-eastern danger of Forrest strait. Vessels running South at night are liable to come near it before they are aware, depths of 6 fathoms being carried to within a mile of it, and being flat it is difficult to distinguish.

Boyce shoal, reported to be about 2 miles east of the Gregory group, opposite Boyce hill, was not found when the strait was surveyed in 1886. Its existence seems doubtful. It was said to have 12 feet of water over it at low water tide, and to have depths of 5 to 8 fathoms close round it.

DIRECTIONS.—Forrest strait.—Forrest strait is used by all steamers and native vessels trading through the archipelago, there being plenty of water and good shelter from westerly winds. With the aid of Admiralty chart No. 216*a* it can be traversed without difficulty. The attention of the mariner is here called to the advisability of taking bearings to summits marked on the chart and not to extremes of land which are affected by distance, mirage, and new growth of foliage. Although the strait (in the track now to be described) is navigated by night by those well acquainted with the aspect of the land, &c., it is not advisable for a stranger to do so, owing to the difficulty of making the channel between Marble patch and Campbell reef.

The same course of S.S.E. $\frac{5}{8}$ E. (*see* page 389), allowing for set, which has been pursued since passing Bushby island, will lead to a position $3\frac{1}{2}$ miles S.W. of Canister rock, whence course should be altered to S. by E. $\frac{1}{2}$ E. for Turret island, visible 17 miles, a bold precipitous rock, which will be seen, if the weather be clear, standing out from the land like a square block. Keeping on this line, which leads in mid-channel between the Gregorys and the main coast, the depths will gradually shoal to 5 and $3\frac{1}{2}$ fathoms at low water. The narrowest part of this channel is between the rocks off Red point (which is no longer red) and Kurrachee rock; but even here the channel is nearly 4 miles wide, and by keeping in less than 10 fathoms Kurrachee rock will be avoided. It should be remembered that Campbell reef covers at high water. When the south end of the largest Gregory bears W. by N. $\frac{1}{2}$ N. haul out to S.S.W. into deep water, whence a southerly course will take the vessel 2 or 3 miles eastward of the Five islands, when steer S. by W. or perhaps more westerly, to avoid the extensive flat of sand and mud lying off the entrance of Pakchan river.

Vessels proceeding to the northward may avoid Kurrachee rock by bringing the smaller Turret island (188 feet) to shut behind the

larger one (340 feet) bearing S. by E. $\frac{1}{2}$ E. until past the danger. Anchorage is good anywhere between High island and Turret island.

The channel westward of the Gregory group although deeper has irregular soundings and is impracticable by night ; by day it should not be navigated without a large scale plan of the strait.

North and South Twin are of small dimensions and have scarcely been examined. They are the westernmost of the islands of this part of the Mergui archipelago, and their approximate position is North Twin, lat. $10^{\circ} 38' N.$, long. $97^{\circ} 42' E.$; South Twin, lat. $10^{\circ} 28' N.$, long. $97^{\circ} 41' E.$, about 10 miles apart on a north and south bearing.

Great Swinton islands are near to each other, and stretch E.N.E. and W.S.W. for about 7 miles. The westernmost island bears S. $\frac{1}{2}$ E. distant nearly 20 miles from the south peak of Clara island. The following small islets on about a N.N.E. bearing, stretch from the Great Swinton islands. Islet with rock westward of it at 4 miles, Red islet at 10 miles, Brown islet at 13 miles, and Ninepin rocks at 15 miles. Ninepin rocks bear South, distant 3 miles from the islets off the south point of Blunt island.

Loughborough passage, lies between the Great Swinton islands and Loughborough island, and is about 2 miles wide. H.M.S. *Dryad*, in February 1871, steamed down the north-east side of Loughborough island about three-quarters of a mile off-shore, with soundings of 17 to 19 fathoms, clay. Nearly abreast of the east point of the island, with Northern Pap bearing S.W. by W. and half a mile from the shore, is Hayward island, with rocks extending north-eastward from it, off which the *Dryad* anchored in 17 fathoms clay, good holding ground, with South Pap S. $40^{\circ} W.$, and Skinner island on with Quoin island S. $45^{\circ} E.$ *

Between Loughborough and Richards islands (to the east), is good anchorage in 8 to 15 fathoms mud, with 3 fathoms close to either shore.

Pollock reef.—The steam vessel *Madras*, in 1875, passed between Loughborough and Swinton islands. Here, in mid-channel, a rock above water and a sunken reef were found, and the vessel narrowly escaped striking. The sunken or Pollock reef, is in about lat. $10^{\circ} 30' N.$ and long. $97^{\circ} 58' E.$ The passage between Loughborough and Swinton islands should therefore be avoided.

* Remark Book of Navigating Lieutenant W. H. Hayward, R.N., H.M.S. *Dryad*, 1871.

O'Connor, Saul, and Skinner islands lie from one to 2 miles eastward of Richards island. They are of irregular form, each about half a mile in diameter, and said to be dangerous to approach on account of rocks. Vessels passing between them and Richards island, should keep nearer to Richards island; the *Dryad* obtained 16 fathoms in this channel when west of Skinner island.

Cavern island.*—There are several islands situated on the south-east side of Loughborough island. The largest of these, on the south part of which are several caverns in which edible bird's nests are procurable, is distant about 5 miles, south-east of Loughborough island. Cavern island is reported to be very narrow in its central part.

ST. MATTHEW'S ISLAND,† situated about 18 miles off the entrance to Pakchan river, and on the parallel of 10° N., is the largest island in this neighbourhood. It is 16 miles in length, 6 miles in breadth, and being nearly 3,000 feet high in its central part, may be seen from a considerable distance in clear weather. Wild hogs and pigeons are plentiful, but the jungle is dense; some fine straight timber grows here, and fresh water may be had, except when an unusually dry season occurs. Tracks of large animals and elk have been observed on the shore of Hastings harbour. The heat was great in April 1871, when H.M.S. *Cossack* visited the harbour.

Hastings harbour, formed by St. Luke's, Hastings, and the north coast of St. Matthew's island, is about 5 miles in extent, and affords excellent and sheltered anchorage in 5 to 1 fathoms, mud. There are two entrances, one north-westward of Hastings island, the other southward of it, for the navigation of which the chart is the best guide; the northern channel is to be preferred.

A rock, dry at low water springs, with 9 to 10 fathoms close-to, lies in the south entrance, with the south point of Hastings island W. by N. $\frac{3}{4}$ N. one mile. Also a rock with 2 fathoms least water, about 40 yards in extent, and 7 fathoms close-to, lies about 4 cables off the south shore, with south point of Hastings island N.N.E. 9 cables. The northern entrance has no known dangers. Several islets lie in the northern approach, with deep water between them, but caution is necessary when approaching, as dangers may exist which are uncharted.

* See Admiralty chart No. 216b, Mergui Archipelago, Sayer island to Loughborough island.

† See Admiralty plan of Hastings Harbour, No. 91.

Russell island is the largest of these islands ; sunken rocks are charted both south and north-west of it, with 20 to 25 fathoms in the channel between it and St. Luke.

Tides.—It is high water, full and change, in Hastings harbour, at 10 h. 40 m. ; springs rise 14 feet. The strength of the spring tide is about one knot per hour.

Fish harbour is a bight in the north-east side of St. Matthew's island, about 2 miles southward of the south entrance to Hastings harbour. It is available for vessels of about 9 feet draught. A small white rock or islet, with deep water around, lies about one mile off the entrance.

OUTLYING ISLANDS.—St. Andrew's group, situated between 10 and 21 miles north-westward of St. Matthew's island, are numerous, with six principal islands named after the letters of the alphabet, A to F.

Horsburgh island (or E) of this group, is the north-western, and visible about 20 miles.

Cockburn islets are situated from one to $2\frac{1}{2}$ miles northward of C island, and are in line on a S. $\frac{3}{4}$ W. bearing.

Parsons rock, consisting of pinnacles which dry from 3 to 4 feet at low water, is situated E. $\frac{1}{2}$ N. distant nearly 2 miles from the north Cockburn islet. The east point of Cavern island bearing North, or the east point of C island, bearing South, leads westward of Parsons rock.

H.M.S. *Dryad* anchored in 13 fathoms, sand, north-eastward of the north point of C island, but in bad holding ground.

ALADDIN ISLANDS, situated south-westward of St. Matthew's, are a scattered group 18 miles in extent. Some of the islands are high and bold.

Davis island, 4 miles from the south-west end of St. Matthew's, one of the largest of the cluster, is nearly 4 miles in diameter, and visible from 20 to 25 miles.

Dunkin island, 3 miles eastward of Davis, is also high ; at half a mile from its east side the depth is from 10 to 20 fathoms.

Western Rocky island, the westernmost of the group, is less than a quarter of a mile in extent, but is of considerable height, being visible from 12 to 15 miles. It is situated in about lat. $9^{\circ} 52' N.$, long. $97^{\circ} 52' E.$

North Rocky island lies $5\frac{1}{2}$ miles E.N.E. from W. Rocky island.

Haycock, another isolated rock, lies 11 miles southward of Western Rocky island, with depths between of 25 to 30 fathoms.

Christie island, the southernmost of the Aladdin group, is of irregular form, and off its south and south-east sides are some rocks above and below water.

Auriol, the south-eastern island, is probably bold, there being 16 fathoms water at a short distance from its east side.

CHANCE ISLAND, situated 10 miles S.S.W. from Christie; is of irregular form, and has several rocky islets in its immediate vicinity. It is 5 miles in extent north and south, 3 miles across at its north end, and its peak is visible upwards of 30 miles in clear weather. Some rocks above water are situated off its south-east side. Chance island should not be closely approached, having been only cursorily examined.

A rock has been reported to lie about midway between Christie and Chance islands, but its existence is doubtful.

Richelieu rock, awash at low water, lies nearly midway between Chance island and the coast. It is charted with the peak of Chance island bearing about W. by N. $\frac{1}{2}$ N. distant $14\frac{1}{2}$ miles, but the position is doubtful. This rock is said to be smooth and oval in shape, about 100 feet long, and in appearance like a ship turned bottom up; in its vicinity is a depth of 17 to 20 fathoms.

Middle island lies S. $\frac{1}{2}$ W., 18 miles from Chance island; it is $1\frac{1}{2}$ miles in extent, and lofty enough to be visible from a distance of 25 miles.

Perforated island, so named on account of a hole through it, lies nearly South, distant 14 miles from Middle island. The depth at one mile from its east side is 46 fathoms.

SAYER ISLANDS.—This group is the southernmost of the Mergui archipelago, and consists of nine islands, densely wooded and steep-to, with the exception of the north-east coast of South island off which a reef extends one cable.*

Pulo Tajah, or Great Sayer island, is 2 miles long, north and south, half a mile wide, and rises at the northern part to a height of 802 feet. At the north-east point is a small cove, with 7 fathoms water. North island, situated 4 cables northward of Great Sayer island, is 326 feet high, and in the channel between these islands are depths of 23 fathoms.

* Remarks by Commander Hon. F. C. P. Vereker, H.M.S. *Maggie*, 1884. See Admiralty chart :—Sayer islands to Bass harbour, No. 842.

Channel rocks, from 15 to 20 feet high, lie 5 cables S.W. by S. from the south-west point of Great Sayer island, and are steep-to.

Centre islands are four in number; the northern is conical shaped and 392 feet high; the southern island of the centre group is 447 feet high, and has two smaller islands nearly connected by a reef situated off its north-east point. In the channel between, there is a depth of 8 fathoms.

Payan island, situated one mile north-east of Sangasiap island, is 151 feet high, and of conical shape.

Sangasiap island, 428 feet high, is $2\frac{1}{2}$ cables broad at its south-west extreme, and narrows gradually to Andrew point, which is broken and cliffy, and 59 feet high.

South island has a double summit, the peaks being 385 feet and 368 feet high, respectively. The sand beach on the north-east side is fronted by a coral reef extending one cable off shore. The observation spot at the eastern end of the beach is situated in about lat. $8^{\circ} 29' N.$, long. $97^{\circ} 39' E.$

Taku rocks, consists of three rocky heads which cover at high water springs, and a few detached rocks, all being steep-to.

Tides.—In the month of January 1884, high water, full and change, was observed to be at 10h. 0m. (approximately), springs rise about 8 feet.

In the channel between Sangasiap and South island, the flood streams sets about east, and ebb about west, while outside, the tidal streams appeared to set N.E. and S.W.

PAKCHAN RIVER* separates the territory of British Burma from Siam. It rises in about lat. $10^{\circ} 50' N.$, long. $99^{\circ} E.$, and is about 80 miles in length. The entrance is situated in about lat. $9^{\circ} 59' N.$, long. $98^{\circ} 33' E.$, and is about 2 miles in breadth, whence the river takes a general north-north-east direction to Kra, a distance of about 40 miles, where the stream is reduced to a breadth of about 250 feet; above this it becomes tortuous.

A small station of the British Burma Customs is established on Victoria point at the entrance of the Pakchan river.

The river is densely wooded on both sides, and numerous streams debouch into it; the principal of these are Maliwun, on the British side, and Klong Bang Pra, Klong Raun, and Klong Lam Lieng on the Siamese side.

* The information relating to the coast of Siam is chiefly from Commander A. D. Taylor, I.N., and Commander A. de Richelieu, of the Siamese Imperial Navy. See Admiralty chart, No. 216b.

Depths.—The Pakchan has depths of 5 to 10 fathoms apparently, for about 10 miles within the entrance points. It is, however, fronted by sand and mud flats to the distance of about 10 miles, with channels over or between them. The channel northward of Victoria island, over the flats, has about 15 feet at low water. The south channel, which runs close along the north side of Saddle island, is apparently deeper, but little is known of this river. Small steamers during the rainy season or south-west monsoon period, can reach the Siamese town of Kra. As the channels from sea are not buoyed, and both the chart and directions are old, they can only be used with considerable caution.

Pilots.—Vessels may take up an anchorage in from 4 to 7 fathoms north-eastward of Delisle island, and there wait for a pilot, but the pilots are stated to be not very trustworthy. This anchorage should be approached south-eastward of Delisle island.

Communication.—Local steamers trade between Pakchan and Moulmein and between Renong and Penang. The smaller steamers of the British India Company sometimes visit the river.

Victoria point, the west point of entrance to Pakchan river, is the south extreme of the Maliwun hills; it is a high bold point, steep-to, and the channel between it and Victoria island is reported to be safe, but caution is necessary when navigating it.

Renong or Ronowng river flows into the Pakchan river opposite to Victoria point, and is small, narrow, and shallow. Renong is in fortnightly communication with Rangoon and Penang.

Goh Phi.—Light and buoy.—At about one mile off Renong river mouth is a small island named Goh Phi, connected with the mainland at low water. A light, visible about 3 miles, is exhibited from a stone tower on Goh Phi. A sand-bank, with its extreme marked by a buoy, extends southward of the island; the channel into Renong river is southward of Goh Phi buoy, and the water shoals gradually towards the mouth of the river, from 5 fathoms westward of the buoy, to $1\frac{1}{2}$ fathoms on the bar.

Town.—About 4 miles up the Renong is a landing place, whence a road leads up to the Rajah's residence (about one mile from the river), but boats can only ascend to this landing place at high tide, as the creek dries at low water. The town of Renong or Ronowng is steadily increasing in importance, and around the town are large tin mines, from which a great quantity of tin is exported.

Supplies.—Fresh water and all kinds of provisions may be obtained at reasonable prices ; also firewood.

ISLANDS in the approach to Pakchan river.—**Victoria island**, a large, low, wooded island of triangular shape, is one mile south of Victoria point. From the mainland to the eastward, large sand banks extend towards this island, and the deepest water is about 2 to 3 cables from the island ; large sandbanks extend southward and westward of the island, but the north side is reported to be steep-to.

Long and South Islands.—About 3 miles to the westward of Victoria point lies a group of islands, the largest of which, named Long island, is about 2 miles in length, high and wooded ; close to its south-east point is a round, wooded island named South island, and to the north-west is North island, of about the same height.

Mostyn, Festing and Dyke islands* to the northward of Saddle island are low and wooded ; they are at low water all connected by sandbanks, and by the Siamese are considered as one island and named Goh Son ; between these islands and the sandbanks extending from the mainland, is a good channel, in which the depths vary from 4 to 6 fathoms at low water.

Goh Chang or Saddle island is the largest and highest of the islands along this coast ; it is about 5 miles long by a little over 2 miles broad, and the highest peak in the middle of the island is in about lat. $9^{\circ} 50' N$. From the east coast of this island, as well as from the mainland opposite, large sandbanks extend, between which there is a channel, which is neither broad nor deep, and it is difficult to find at high water ; at low water the sandbank dries on both sides.

Off the south-east point of the island are some wooded islets, and a sandbank extends along the whole of the south-west coast of the island. Off the west coast lies Tree islet, low and rocky, with small trees on it ; off the north-east side are some islets or rocks only a few feet above water ; there is a depth of 6 and 7 fathoms within 2 cables of the west side of Tree islet, apparently the best track in.

Harry head.—**Banks.**—Harry head, the north-west point of Saddle island, is a high bluff, covered with trees, and there is said to be a rock near it.

The north side of Saddle island is low and covered with jungle, and there are depths of 5 to 6 fathoms along it. The north-east point

* The boundary between Burma and Siam is considered to run through Mostyn, Saddle, and Delisle islands ; these islands and the adjacent waters are not surveyed.

is also low, and about east from it lie some small, low, rocky islets, only a few feet above high water, steep-to on their north side ; the north-eastern of these is Stainer rock.*

About half-a-mile north-westward of Harry head is a small wooded island, known as Spiteful rock (about 100 feet high), to the south-west of which there is a narrow sandbank with about one fathom on it at low water ; this bank, reported to have formed since about 1860, is about $1\frac{1}{2}$ miles long and very narrow.

Delisle island (Goh Piam) is high, about 4 miles long and 2 miles broad ; along its west coast stretches a reef of rocks with from 8 to 10 fathoms water within one mile of them. About three-quarters of a mile south-west from the south point of the island, is a rock which dries about three feet at low water spring tides, with 7 to 8 fathoms close to. Between the east coast of this island and the mainland are large sand banks, but there is a channel along the island side.

Anchorage.—On the north-east side of the island there is good anchorage in 5 or 6 fathoms water sheltered from the south-west monsoon. Northward of the island, between it and Saddle island, there are depths of 5 to 7 fathoms, but there is a sandbank about 4 cables from the north point of Delisle, on which the depth is about 2 fathoms at low water.

DIRECTIONS for channels northward of Victoria island.†—Approaching Pakchan river from the northward do not stand into less than 8 fathoms towards the flat off the Siam coast, until the open sea is visible between Hastings island on the one side and St. Luke's and St. Matthew's islands on the other, when the vessel will be about 10 miles south-west from Long island. Then haul round to the south-eastward until North island is only just open of the west point of Long island, bearing N.E., when steer straight for it. In this channel are depths of 4, 5, and 6 fathoms at low water. When South island bears East, steer straight for its south point, passing about a cable from it, in order to avoid two patches of rocks, awash at half-tide, lying about 3 or 4 cables southward of South island.

When past South island, there are no dangers except those visible. Vessels attempting this passage, should, if Long and North islands

* In 1891 H.M.S. *Plover* struck a wreck or a rock, with about 10 feet water on it, when Stainer rock bore S.E. by E. $\frac{1}{4}$ E., distant about $2\frac{1}{2}$ cables.

† Commander A. D. Taylor, Indian Navy, 1876. See the opening paragraphs on the Pakchan river.

are not plainly visible, bring the north point of Saddle island to bear East, and the highest peak on St. Matthew's island N.W. by W. $\frac{1}{2}$ W., and then steer N.E.; this course will lead in about midway between the banks, as before. When Long island is seen, it should, as previously directed, be brought to almost touch North island.

Another route, is to run in about E. $\frac{1}{2}$ N. towards Boundary island, keeping the sloping south extreme of that island in line with a small round island eastward of it. On this course there is not less water than 5 fathoms. When Victoria point is seen, steer for it, keeping it in line with the north-west point of Victoria island and crossing the flat in not less than 3 fathoms at low water. When within a quarter of a mile of Victoria island, haul to the northward, and proceed as before directed.

In all the channels the flood stream sets northward, and the ebb to the southward, at the rate of 2 to 3 miles an hour.

Channel northward of Saddle island.—Sailing vessels should not attempt this channel on account of the strong tides.

The best passage for steam-vessels is said to be that northward of Saddle island. From either northward or southward steer for the centre of Saddle island when bearing between E. by S. $\frac{1}{2}$ S. and N.E. by E. $\frac{1}{2}$ E., as far as within about 2 miles of it, or until Tree island, off the west side of Saddle island, is made out. Then steer to pass from 2 to 3 cables westward of Tree island, thence in between Saddle island and Spiteful rock, keeping in mid-channel between that rock and Harry head of Saddle island; thence alter course to pass rather more than a quarter of a mile northward of Stainer rock (a small, low, and rocky islet, with trees about its centre, lying about east from Harry head); on this course the depths are 5 to 6 fathoms, and the banks to the southward of Mostyn island will be avoided.

From abreast Stainer rock, haul up towards Dyke island, care being taken to avoid the rock at the extremity of a spit extending eastward of Mostyn island; thence pass about two cables eastward of Dyke island; on this course the depth is 4 to 5 fathoms; pass the islands lying immediately southward of Victoria island at about one cable distance, and Victoria island from 2 to 3 cables, to clear the large sandbank which extends from the mainland south of Renong river.

Anchorage.—If anchoring at the mouth of the river, bring Goh Phi to bear East, and anchor about a mile westward of that island in $3\frac{1}{4}$ fathoms at low water.*

* From remarks by Sub-Lieutenant D. E. M. Brownrigg, H.M.S. *Plover*, 1891.

Caution.—As before remarked, both the chart and directions must be used with extreme caution. Steam vessels using this passage should keep a good speed in passing between Saddle island and Spiteful rock, as the tides here are sometimes strong; both flood and ebb streams set over towards Spiteful rock and the sandbank to the south-west of it. The tidal stream has in this passage been known to run at spring tides at the rate of 4 and 5 knots an hour. When past this entrance there is smooth water and good shelter from the south-west monsoon: sailing ships should, however, not attempt this passage. Steam vessels coming from the north should get well to the southward before they steer for Saddle island, in order to avoid the sandbank extending from Spiteful rock.

Maliwun river* enters the Pakchan river about 12 miles above the entrance of the latter, and is a broad and deep stream, available for vessels of 12 to 13 feet draught, as far as the entrance to Lama river. Above that the Maliwun becomes tortuous and narrow, and can be navigated only by boats. At Maliwun an Assistant Commissioner resides, and tin smelting is roughly carried on.

Directions.*—From abreast Victoria point keep in mid-channel, and pass eastward of the rocks, which show above water, off Goh Korlek; then close the western bank of the river, and proceed westward of all the islands up to the entrance of Maliwun river, thence in mid-channel to anchorage below entrance to Lama river. To proceed up the Pakchan river above the Maliwun, steer between Goh Mut and Goh Khuang, where there is a depth of about $16\frac{1}{2}$ feet at low water, then close the western bank of the river, keeping about 2 cables from it, and taking care to avoid a rocky patch which dries about 4 feet, and lies about $1\frac{1}{2}$ cables off the northern entrance point of the Great Kumaon river. Continue about the same distance from the western bank past the entrance of the Little Kumaon river. A rocky patch, which dries at three-quarters ebb, lies about half a cable from the western bank, three-quarters of a mile northward of the entrance to Little Kumaon river. Vessels of light draught can proceed as far as Well hill, about 4 miles above Little Kumaon river, keeping the western bank. Above Well hill the river is only navigable for light draught steamers (10 feet) at high water.

Tides.—It is high water full and change at the anchorage off Goh Phi at 10h. 40m.; springs rise between 11 and 12 feet, and neaps 8 to 9 feet. The ebb tide rushing out of Pakchan river splits at the

* From remarks by Sub-Lieutenant D. E. M. Brownrigg, H.M.S. *Plover*, 1891.

north-east point of Victoria island, one part setting to the west and the other to the south; both streams being rapid at spring tides. Tidal influence is felt in the dry season for 10 miles above Kra, at which place the spring rise is 8 feet.

THE COAST.—From the mouth of Pakchan river the coast of the mainland takes a south direction for about 44 miles, to the mouth of Taukopah or Kopah inlet; it is unexamined, and should not be approached without a pilot. The coast is mostly low, densely wooded, and intersected by a great number of rivers and creeks. Inland is a range of mountains about 10 miles from the coast, the highest and most remarkable peak of which is Kau Da Chung Dung; it presents an almost perpendicular appearance. Off the coast are a number of islands, mostly surrounded by reefs, and connected with the mainland by sandbanks.

Sugar Loaves.—About 11 miles southward of Delisle island is a group of high, bold islands named the Sugar Loaves; the group consists of two large islands (Goh Jam Jai and Goh Jam Nai) and several smaller ones. Goh Jam Jai, 700 feet in height, the largest and highest, is the western island of the group, and there is 10 fathoms of water 3 miles westward of it.

About 2 miles south of this group is Goh Lan (or Metcalf island), also a high and wooded island; north-west from it, is a small island and a rock. About 3 miles north-east from the group is Goh Kang Kan (Sir Elijah Impey island), a high and wooded island, surrounded by rocks.

Goh Khai Jai (Hayes island) is a round, high, wooded island about 10 miles southward of the Sugar Loaves, and about 4 miles north from Kopah head; north-west from it is a smaller rocky island (Umbrella island, Goh Khai Nai), so called on account of having a single tree on its highest point looking somewhat like an umbrella. Both these islands are surrounded by large sandbanks and rocks, and at low-water the sea breaks in several places to the westward of them.

Goh Kah or Rah is a high, thickly wooded island, with deep water along its western coast; it lies north of Goh Phra Tang, and extends in a northerly direction for about 5 miles. Kopah head is its northern point.

Shoal.—A shoal, with a depth of about 3 fathoms on it, lies with Kopah head S.E. by E. $\frac{1}{2}$ E., $2\frac{1}{2}$ miles; and Hayes island summit N.E. $\frac{3}{4}$ N.*

* Sub-Lieutenant D. E. R. Brownrigg, R.N., H.M.S. *Plover*, 1891.

Vessels coming from Taukopah bound northward should, from abreast Kopah head, steer west for about 5 miles, when they can haul to the northward, giving Hayes island a berth of about 5 miles.

TAUKOPAH (or KOPAH) INLET* is a large river, in the province of Muang Taukopah belonging to Siam; it has three entrances, the principal one, Pak Kura, lying between Goh Kah and the mainland, about 4 miles south of Hayes island. For a distance of 15 miles below the town, the depth is only from 4 to 5 feet at low water springs; between this and the sea there is apparently not less than 2 fathoms.

Pak Kura.—Directions.—The directions for Kopah inlet must be used with caution, as the survey is very old, and changes take place. Approaching Pak Kura, Kopah head should be steered for when bearing East to avoid the shoal west-north-westward of Kopah head. Pass the head and round the north end of Goh Kah at the distance of half a mile, where there is a depth of 5 to 6 fathoms. From the north-east point of Goh Kah steer S. by W. $\frac{1}{2}$ W., keeping close along the island side, and passing about 2 cables distant from a projecting bluff, on the east side of Goh Kah, in order to avoid a sand spit which extends from the mainland to within 3 cables off this bluff; on this course are depths of 4 and 5 fathoms.

When past the bluff, steer South for about $1\frac{1}{2}$ miles, and then haul gradually to the south-eastward, to the middle of the river; in this reach depths of 3 fathoms at high water have been reported. On approaching the end of this reach, a large group of fishing stakes will be seen on the mainland side, and to the south of two small islands, which, when sighted, steer straight for; this course will clear a sandbank extending from the east point of Goh Phra Tang, and a smaller bank, with $2\frac{1}{4}$ fathoms at low-water, lying 3 cables north-east from it. When close to the fishing stakes, steer about S.W., keeping in mid-channel, and passing eastward of a black beacon, surmounted by a cone, which marks a patch of broken ground, on which in some places is a depth of only 9 feet at low water springs, off Macaulay point; on this course are depths of 4 to 5 fathoms. In passing the beacon, the mainland side of the channel should not be approached too closely, as a sand spit which dries at low water extends well into the channel north-eastward of Feather tree. A vessel of 12 feet draught may anchor about half a mile northward of Feather tree.

* See Admiralty chart, Southern part of Mergui Archipelago, No. 2163.

Smaller vessels may go up the river towards Taukopah by steering for the north point of a small rocky island, near the entrance of the river, and then passing within 50 yards of it; here there was a depth of $2\frac{1}{2}$ fathoms at low water spring tides, but the water appears to be getting shallower every year. After passing the island, steer to the south-east, keeping in the middle of the river for about one mile, and then anchor in 2 fathoms at low water, close to a small creek, through which boats, instead of following the main river, can go up to Taukopah town, thereby saving considerable time. This creek is very shallow, and at low water passable only for small boats. From this upper anchorage the main river runs in a south-east direction for about 5 miles, then turns off to south-south-westward for about 4 miles, and then in a southerly direction for about 5 or 6 miles. Above the upper anchorage, however, the river is shallow, and steam cutters can only get to a point, which is about 4 miles from the town by river, and $1\frac{1}{2}$ miles by road.

The town of Taukopah, where the Rajah resides, is situated (in lat. $8^{\circ} 48' N.$) about 15 miles from the upper anchorage, on the west side of the river, and is surrounded by tin mines and large plantations; the inhabitants are mostly Chinese. The only export is tin; next to Tongka it is the largest tin-exporting place on the coast of Siam. The houses are mostly of bamboo and atap, but there are some brick buildings, and a good market, where provisions and vegetables may be procured. Besides Taukopah, there are several mining villages along the banks of the river, and the land about the town and to the northward is undulating, mountainous, and can be seen from a long distance seaward.

Pia Sima, the highest mountain in the vicinity of Kopah inlet, and about 10 miles to the eastward of Goh Kah, culminates in three peaks of nearly equal elevation, and is upwards of 3,500 feet high.

Communication.—There is fortnightly mail communication with Rangoon *viâ* the coast, and Penang *viâ* Tongka.

Tides.—At the anchorage 15 miles below Taukopah it is high water, full and change, at 10h. 40m.; springs rise about 10 feet, neaps 7 to 8 feet. The tides in the river are, on account of the many outlets to sea, very irregular; the stream seldom runs at the rate of more than 4 miles an hour in the upper part, and from 2 to 3 in the lower part of the river.

Along this coast from Goh Kah to the south point of Junkseylon, the flood stream sets to the northward, the ebb to the southward, at

the rate of ~~from one to 2~~ miles an hour, within 10 or 12 miles of the coast ; farther out it is ~~weaker and~~ more dependent on the winds.

Pak Kruen.—**Directions.**—Pak Kruen the middle entrance to Taukopah inlet, is about 15 miles south of the Kura (~~Kopah~~) entrance and has on each side a large sandbank partly dry at half tide, and extending from one to $1\frac{1}{2}$ miles seaward, on both sides of the entrance. In the approach, is a large sand flat on which is a depth of about $1\frac{3}{4}$ fathoms at low-water spring tides ; this bar or flat, seems to have the same depths all over and without any deeper channel across it. In the channel between the points, the deepest water 5 to 7 fathoms, is along the north bank.

In the north-east monsoon, when bound out from Taukopah inlet, if of very light draught, this channel is safe and easy, and when between the sand banks a W.S.W. course will lead straight to sea.

Entering the river from seaward this channel is more difficult (as the entrance between the sandbanks off the points, cannot then be seen), and it should not be attempted without local knowledge. The sandbanks here are not shifting, and the passage remains the same. When the sandbanks are passed, a channel with 6 and 7 fathoms water, leads into Taukopah river. In the south-west monsoon there is generally a heavy swell on the bar, and the northern entrance (Pak Kura), is then much to be preferred.

Lem Goh Phra Tang.—On the north side of the entrance to Pak Kruen is the south-west point of Goh Phra Tang, a large, low, thickly wooded island extending in a north and south direction about 9 miles ; it is separated from Goh Kah to the northward by Pak Tjik, a narrow entrance nearly choked by sandbanks and rocks, and only passable for boats. The west coast of Goh Phra Tang is low and sandy, with 7 or 8 fathoms water at about one mile off.

Goh Gah is a small sandy island about one mile from the coast and 7 miles southward of Pak Kruen ; on the island there are a few small trees, and it is surrounded by extensive sandbanks, which are fronted by a circle of rocks lying in from 2 to 5 fathoms water, partly visible at low water. To the south-westward, outside of this circle are some rocks, but the other sides appear clear of dangers ; depths of 5 to 6 fathoms extend for some distance westward of the rocks, but vessels should not approach this island nearer than 4 miles. Between the island and the mainland are sandbanks with only a few feet of water on them ; 4 to 5 miles west from the island are depths of 10 and 12 fathoms, but shoal casts of 5 and 6 fathoms water have been reported in this direction.

Pak Goh (Bangri).—Directions.—Pak Goh, about 4 miles south-south-east from Goh Gah, is the southernmost of the three entrances to Taukopah inlet; it is a passage between sandbanks, with from $2\frac{1}{2}$ to 3 fathoms at low water for about 2 miles; the course in is E.S.E. between the sandbanks, direct for the low casuarina tree point on the south shore. Inside the bar the channel deepens to 5 and 6 fathoms, for a short distance, whence it becomes narrow and shallow. The sandbanks in the entrance are said not to shift in the monsoons, and the channel to be the same now as it has been for many years. The land around is low and richly wooded, but there are numerous small creeks, and at high water a large part of the country around is flooded, making it little else than a mangrove swamp. During the fine season this entrance may be made use of with advantage, but in the south-west monsoon the northern entrance is the only safe one.

Tides.—It is high water, full and change, in the Pak Goh entrance at 10h. 40m.; the flood and ebb streams are regular, and run from 2 to 3 knots an hour.

Lem Krang Nai is a low point about 3 miles southward of Pak Koh; from this point reefs and broken ground extend about one mile off.

Lem Krang Jai, situated 5 miles southward of Lem Krang Nai, is a low, sandy point, covered with high trees; from the point a reef extends for a distance of about 2 miles in a westerly direction; some of the rocks are visible at low water. This point should not be approached nearer than 3 or 4 miles, or to a less depth than 10 fathoms; indeed the whole coast from Lem Krang Jai to Lem Lajan 8 miles to the southward, should not be approached too closely, as the ground is rocky and uneven. The coast between Lem Lajan and Klong Kokak is high, with hills close to the sea, but from Klong Kokak to Lem Krang Jai it is low and wooded. To the southward of Lem Lajan the coast is also low and wooded.

Klong Kokak is a river about 4 miles north of Lem Lajan, some distance up which stands the village of the same name; there are important tin mines in the vicinity. Large sandbanks extend some distance off the mouth of the river. About one mile north from Kokak is another smaller river.

LEM THAM TJOB (Cape Dolphin), 500 feet high, bold, and steep to on the western side, having 10 fathoms at a short distance, is the only high point close to the sea between Goh Kah (at the mouth of Taukopah inlet) and Lem Kho Phra Chao on Junkseylon. To the

northward, Lem Tham Tjob forms a long sloping point, on the extreme north of which are two small hills; from the point, rocky ground extends in a northerly direction for about 5 cables, most of the rocks being visible at low water. The high land of this cape forms the west or left bank of the river Bagatae.

KLONG BAGATAE or **Tang Pran** is a river to the eastward of Lem Tham Tjob; it is broad and deep in the entrance for about 3 miles, there being 4 to 6 fathoms for that distance; here, abreast Klong Gatae is a rock above water, above which vessels drawing more than 8 to 9 feet cannot ascend.

Ban Tapmo is a small village in the mouth of Klong Lam Rin (first creek on eastern bank), but the large village of Ban Bagatae is situated some miles farther up this branch of the Bagatae river. Fresh provisions and water may be had here. Numerous creeks and small rivers fall into Klong Bagatae, and several villages are situated on its banks. There are important tin mines close to this river, but they are being worked under disadvantages, as, in consequence of no steamers calling here, the tin has to be carried on elephants, over high hills, to the Rajah's residence in Takuatung.

The anchorage in the river is good and well sheltered from all winds; the bottom, mud.

Directions.—The river may be safely entered by steering East, for Lem Lajan, a high hilly point about $1\frac{1}{2}$ miles northward of the entrance; this leads northward of the rocks extending about half a mile from Lem Tham Tjob point; on the western side, between Lem Lajan and Lem Tapmo, is a sandbank fronted with rocks nearly one mile off shore, mostly visible at low water. When the river is fairly open, steer straight in, keeping to the Lem Tham Tjob side, where the deepest water is, and inside the north point of which there is no danger. When off Ban Tapmo, vessels can anchor in 3 to 5 fathoms, the deeper water being to the westward.

Hin Lompuk is a group of rocks about 6 feet high, lying about one mile north-west from Bataluk, at about half a mile off the coast, with depths of 5 to 7 fathoms close to; north-eastward from them are two smaller rocks close to the coast.

Ban Tasai is a village about 4 miles northward from Bataluk, where Klong Tasai turns to the eastward. Fresh water is plentiful here (Klong Tasai being fresh). Between Ban Tasai and Lem Tham Tjob are a few villages. The coast from Lem Tham Tjob to Lem

Pak Phra (Hin Lompuk excepted) appears clear of danger, the water shoaling gradually to depths of 6 to 8 fathoms about half a mile off the coast.

Bataluk is an inlet into which three small rivers debouch, namely, Klong Gva from the south, Klong Kli from the east, and Klong Tasai from the north; the latter is the largest, and runs parallel with the coast (from which it is only separated by a sand-bank) for about 4 miles, and then turns off to the eastward. At the entrance to Bataluk are shallow banks of sand, but they do not extend far out. At Ban Bang Kli, a village at the mouth of Klong Kli, water and poultry may be procured.

The coast of the Siamese province of Takuatung, from Lem Tham Tjob, southward to Lem Pak Phra, at the entrance to Papra or Pak Phra strait, is low, sandy, and densely covered with trees. Lem Pak Phra, the south-west point of the province, is rendered remarkable by a group of high trees. About 4 miles south of Bataluk inlet is a small hill named Pilai, close to the water's edge, which may be useful as a mark for making Papra strait, as it is the only hill on the coast between Lem Tham Tjob and Lem Kho Phra Chao in Junkseylon. The coast between should not be approached nearer than 3 miles, as it has not been closely examined.

MALACCA STRAIT. MALAY SHORE.

UJONG SALANG or **Junkseylon island**,* occupied by the Siamese of Ligor, is separated from the Malay peninsula by Papra (or Pak Phra) strait, and extends between lat. $8^{\circ} 10' N.$ and $7^{\circ} 46' N.$; it is about 24 miles long, 9 miles broad, and divided into two Rajahships of about equal size; the northern being named Salang, and the southern Puket. The population of Junkseylon, composed of Malays, Chinese, and Siamese (in 1879), was about 32,500. The principal towns are Bandon, Tongka, Kathu, and Tharua the old capital. The north shore of Papra strait is under the Rajah of Takuatung.

Junkseylon is rich in tin mines, which appear to have been worked by Chinese miners for centuries. The mines employed (in 1872) nearly 35,000 Chinese, but since then there has been a steady decrease in the number, owing to the depreciation in the value of the

* Remarks (amended) of Commander A. de Richelieu, Siamese gunboat *Coronation*, 1876. Lem (Siamese) means point or cape; and Goh or Koh an island. See Admiralty charts:—Bassein river to Pulo Penang, No. 830; Sayer islands and adjacent coast, including Junkseylon, No. 842.

metal. The mining, in many places, is worked in the primitive manner the Chinese adopt, the result being that during the dry season operations are stopped for three months for want of water.

THE WEST COAST of Junkseylon trends nearly north and south, and has several large bays, with deep water, but none affording any protection during the south-west monsoon. The northern half of this coast is low wooded land, with the exception of a small portion at 8 miles from the north point of the island. The southern half is a range of mountains 1,000 to 1,750 feet high, thickly wooded, sloping gradually to the northward and southward, and visible at a distance of 30 miles. This side of the island is steep-to, with 10 or 12 fathoms close to the shore. Off the west coast are two small islands, named Goh Gata (Gavai), one of which is 50 feet high, the other lower; they lie close together S.W. by W. $\frac{1}{2}$ W. one mile from Lem Són (which is 8 miles southward of the north-west point of Junkseylon), and have deep water around them.

Bandon river lies just south of Lem Són; on it is the town of Bandon, which contains about 100 houses.

PAK PHRA or PAPRA strait, about half a mile in width, separates Salang (Junkseylon) from the Malay peninsula, and is about 14 miles long. The natives are very superstitious about this strait, its name signifying Lord's mouth; the passage is much used by junks. The land on both sides is mostly low and wooded, but the capes or lems are high. Along both shores of the strait are several villages where provisions and water may be obtained.

Bar.—Directions.—The depth on the bar at the western entrance is subject to much variation, ranging from one to 3 fathoms at low water; the passage of the strait should not be attempted without the assistance of a pilot. Off the north point of the entrance, a reef of rocks, only visible at low water, extends a short distance; shallow and shifting sandbanks front both points.

In the south-west monsoon the sea breaks entirely across the entrance, but in the north-east monsoon the bar is generally smooth.

Inside the bar there is good anchorage in 5 or 6 fathoms; and from thence to Lem Khun there is a good channel with 4, 5, and 6 fathoms at low water.

The narrowest part of Papra strait is between two points, Lem Hin on the continent and Lem Khun on Junkseylon, $4\frac{1}{2}$ miles within the west entrance, to the eastward of which there is a sand-bank dry at low water; to the southward of this bank the depths are 9 feet

at low water, whilst 4 and 5 fathoms are to be found on the north, west, and east sides of the bank. Another large sand-bank extends from the west side of Lem Asam, between which bank and the aforesaid bank lies the channel.

Goh Galah is a small white rocky island situated $1\frac{1}{2}$ miles to the south-east of Lem Khun. Goh Janak is a small island lying a quarter of a mile to the south-west of Goh Galah. To the south-west of Goh Janak there are extensive sand-banks dry at low water, and to the south is Tamaprau river, on the banks of which, at 2 miles from the mouth the town of the same name stands, and again, $1\frac{1}{2}$ miles further is a larger town, Muang Mai, but boats cannot go beyond Tamaprau.

To the eastward of Goh Janak and Goh Galah there is good anchorage in 4 or 5 fathoms.

Pass on the north-east side of Goh Galah at 2 cables distant, and then steer S.E. to pass Lem Sai (on Junkseylon) one or $1\frac{1}{2}$ cables distant; in this part there are depths of 4 and 5 fathoms. Thence steer E. by S. to pass about 2 cables northward of Goh Rangam Jai (Passage island of old English navigators), a round island, like all the rest in this locality, covered with trees; between these two places the channel, which is formed between the fringing sand-banks, is little more than a cable wide, has 12 feet at low-water springs, and is composed of soft mud. From Passage island steer East, to pass about 3 or 4 cables southward of Goh Rangam Noi, the water gradually deepening as the latter is approached; pass Lam Lem or cape Three points the north-east point of Junkseylon at 3 or 4 cables distant, and with 7 fathoms water. Thence E. $\frac{1}{2}$ N. to pass 5 cables southward of Goh Leng and 3 cables northward of Goh Thanan or Pulo Chupo, a small round island one mile east of Lam Lem. Pass one mile eastward of Goh Thanan, and then, if bound to Tharúa harbour, steer between Goh Ret and Goh Naka Joi in about 6 fathoms water.

Tides.—The tides in Papra strait are very irregular. At the bar the times of high and low water seem to correspond nearly with those at Puket. In the strait, the flood stream sets in from both sides at the same time and meet at the sand bank of Lem Khun. The ebb stream also runs out of both entrances to the strait at the same time. In the middle of the strait there is hardly any tidal stream, but the water rises and falls from 6 to 8 feet. At the west entrance of the strait the tidal stream sometimes runs at the rate of 6 knots; at the east entrance it generally attains only half that velocity.

THE SOUTH COAST of Junkseylon forms a large bay (Khelong bay) with shallow water, the south-west point of which

is Lem Voalan. At nearly three-quarters of a mile to the southward of this point lies Goh Keo Jai or Pagoda island, on the north-west point of which there are two white pagodas. Between this island and Lem Voalan there is a safe passage having 8 to 10 fathoms water. To the southward of Goh Keo Jai stands another island, Goh Keo Noi, smaller than the former, but of equal height and covered with trees. Besides these two islands there are five others along the south coast of Junkseylon, all high and wooded, with depths of 5 to 10 fathoms round them, except along the north side of Goh Khalom. The inner passage round the south coast is deep ; it runs between Lem Voalan and Goh Keo Jai, to the southward of Goh Aú and Goh Khalom, and northward of Goh Hi and Goh Bon.

Khelong bay.—During the south-west monsoon the best anchorage is in 5 fathoms, at about 3 cables northward of Goh Aú. In the north part of Khelong bay are two small rivers, Reusong and Mudong, both leading to large villages where water and provisions may be had in abundance at reasonable rates.

In the inner passage the flood streams set to the eastward, and the ebb to the westward, at the rate of from one to 3 miles an hour.

THE EAST COAST of Junkseylon trends north and south, is fronted with numerous islands, and has two harbours, namely, Puket or Tongka, and Tharúa. Between the east coast and Pulo Panjang there is a broad channel, in which the flood stream sets to the northward and the ebb stream to the southward, at the rate of 2 to 3 knots an hour.

PUKET (or Tongka) HARBOUR lies northward of Khelong bay. Tongka is the principal place in Junkseylon, the residence of the Rajah, and the only port frequented by coasting steam vessels. The only export is tin, of which about 6,000 tons leave Tongka every year.*

LIGHT.—A lighthouse is in course of construction on Goh Tapaunoi, from which a *revolving white* light, visible about 15 miles in clear weather, will be exhibited. During the progress of the works, a provisional light, visible about 5 miles, is shown from Goh Tapaunoi.

Pulo Sirih, an island only separated from the shore by a narrow creek, which at low water is impassable even for boats, forms the north-east extreme of Puket harbour ; its south-east point is named Lem Atpha.

* See Admiralty plan :—Puket, or Tongka, harbour, No. 843 ; scale, $m = 1.95$ inches.

Town.—The town of Tongka lies about one mile up a small creek. At high water boats can ascend to the town, but at low water the creek is nearly dry. There is a road from the harbour master's office and pier to the town. The buildings in Tongka are mostly wooden houses with thatched roofs, but there are a few brick buildings. The principal are, the Government house, the residence of the Siamese Royal Commissioner, the stamp office for tin, the barracks and Commandant's house, and several tin-smelting houses.

Mails.—There is a weekly mail service between Puket and Penang, and a fortnightly mail to Rangoon and intermediate ports.

Supplies.—Fresh beef is difficult to procure, but poultry and vegetables are plentiful, and can be obtained at reasonable prices. Water (not very good) is brought alongside. Coal cannot be procured, but firewood can be purchased. Good fresh water can be taken from two wells, one on Goh Tapau Jai (Pulo Kapal Besar), the other on the north side of Nambo point, the point to the north-west of that island.

Six miles west of Tongka is the town of Kathu, containing about 8,000 inhabitants, principally Chinese miners. There is a road between Tongka and Kathu, but in 1889 it was reported to be almost impassable.*

Anchorage.—The harbour is divided into two anchorages by a sandy flat, over which there are only from 6 to 9 feet at low-water spring tides, therefore, only small vessels go into the inner harbour, in which there is anchorage in about $2\frac{1}{2}$ fathoms; there is said to be more water than is shown on the chart.

Vessels of moderate draught should anchor in from 4 to 5 fathoms, about half a mile northward of the east extreme of Goh Tapau Jai.

The bottom, at both inner and outer anchorages, is mud. The harbour is open to east and south-east winds, during the prevalence of which there is a little swell.

Tides.—It is high water, full and change, in Puket harbour at 10h. 10m., springs rise 9 feet, neaps 7 feet; during the south-west monsoon the day tides are higher than the night tides. In the north-east monsoon the night tides and the day tides are equal. Very little tidal stream is felt in the harbour.

DIRECTIONS.—Lem Phan Va, the south-east point of Junkseylon is steep-to on its eastern side, but a reef, with rocks awash at high water extends nearly one mile south-west from the point. Vessels proceeding to Puket, when off this point, should steer north-eastward until Tongka hill is seen bearing N.N.W. between

* Hon. W. Maxwell, Acting Consul for Siam, 1889.

Tapau Noi and Tapau Jai islands, when it should be steered for, passing between those islands in a depth of 4 fathoms; the same course continued leads to the anchorage in the outer harbour.

If bound to the inner harbour bring the east extreme of Goh Tapau Jai to bear S. by E., astern, and proceed on this bearing until Lem Atpha, the north-east entrance point of the harbour, bears E. by N. $\frac{1}{2}$ N., when anchor as convenient.

Coming from the south-eastward, the passage southward of Goh Gai and Goh Dakmai is recommended. Light draught vessels may enter the harbour by passing 3 cables northward of Goh Tapau Noi, thence as before directed. From the south side of Goh Tapau Jai a rocky reef, with a small islet and sand-banks, extends southward to a distance of one mile.

Winds and Weather.—*January.*—Steady north-east monsoon; wind generally more to the east-north-east and sometimes east. The wind is generally stronger in the evening and night than in the daytime. Temperature between 60° and 80°. No rain.

February.—Steady north-east monsoon the first half of the month with no rain, and generally blowing fresh. In the latter part of the month the north-east monsoon becomes weaker, and is squally every three or four days, generally in the evening and from the northward. In this month fresh water is very scarce, there is also much fever and other sickness amongst the natives.

March.—North-east monsoon very weak, generally from north, and sometimes north-west with occasional squalls from the north-east. Temperature between 75° and 90°. Great scarcity of water and much sickness on shore.

April.—Change of monsoon, winds from west to north; heavy squalls from the north-eastward generally occur with high water in the afternoon or evening. The night tides are very low. There is much sickness.

May.—The burst of the south-west monsoon occurs in the first week of May, after which the wind seldom blows from the east quarter. The heavy rains now commence, and squalls are frequent. On the west shore of Junkseylon the swell is heavy, but Puket harbour is well sheltered.

June.—South-west monsoon fairly set in with heavy squalls from the south-west and north-west. When rainy weather sets in it usually lasts for five days, after that there is generally fine weather (without

rain) for about a week, and sometimes for a fortnight. Temperature between 60° and 80°. Day tides higher than night tides.

July.—South-west monsoon, with squalls and heavy showers; generally the weather is rainy for about five days and then fine again for about five days. When the wind is south-west, there is rain; when west and north-west, fine weather.

August.—Strong south-west monsoon the entire month, with squalls and heavy rain, much the same as July, but in August the rain sometimes continues for ten and fifteen days, and is usually followed by the same period of fine weather. Heaviest squalls generally at night-time. Mean temperature 82°. This is the hottest month, and the greatest rainfall occurs, the average number of rainy days being from eighteen to twenty.

September.—Strong south-west monsoon, but the wind more from westward. Fewer squalls, but heavier and longer showers of rain than in August. Rainy days about eighteen. Fine weather generally lasts but one or two days at a time.

October.—During the first half of month south-west monsoon is steady; towards end of the month the wind is very unsteady; westerly and south-west still prevailing. Showers not so heavy as in September. Rainy days about fourteen. Weather cloudy. Mean temperature 80°. Day tides still higher than night tides.

November.—Weather variable. West and south-west winds still prevailing, but often veering to the northward and eastward; heavy squalls from all quarters, but heaviest from south-west. Rainy days about fourteen. Weather very cloudy the whole month, generally three or four days fine at a time.

December.—North-east monsoon setting in strong and with heavy squalls from north-east, wind generally to the eastward of north-east; sometimes heavy squalls from the north-west accompanied with lightning. Average number of rainy days six or eight. Mean temperature 80°. Towards the end of this month mostly clear weather. Day tides and night tides of equal height.

THARÚA HARBOUR is the next large bay to the north of Puket. The town of Tharúa, which is situated $1\frac{1}{2}$ miles up a small river of the same name, was formerly the residence of the Rajah of Puket, who in 1859 removed to Tongka; previous to 1796 (when Tharúa was demolished by the Burmese) it was a town of considerable importance. At that time there was a large Portuguese settlement

here, and the harbour was frequented by numbers of European vessels ; there is, however, no trade at Tharúa. The ruins of a fine market street, composed of large brick buildings, and the spacious houses belonging to the Europeans who once resided here are still to be seen ; an evidence of its former importance.

The entrance to the harbour is northward of Alang Noi, the small islet northward of Alang Jai.

Directions.—Entering the bay steer to pass about half a mile to the northward of Alang Noi in 8 fathoms, after passing which the water will shoal gradually towards the anchorage, where there is a depth of 3 fathoms, mud bottom, with Alang Noi bearing E. by N., and the middle of Goh Maprau about South. There appears to be a shoal about half a mile to westward of Alang jai ; and vessels should not attempt to pass between Maprau and that island, as the channel is foul. Farther northward are three other islands, Goh Peh, Goh Naka Noi, and Goh Naka Jai ; patches of rocks extend for $1\frac{1}{2}$ miles north-westward of Naka Noi. Between these last three islands and Junkseylon there is a good channel, with 4 and 5 fathoms of water.

Klang Bangkrong, westward of Goh Naka Noi, is a river leading to the old residence of the Rajah of Salang.

Goh Mai Tan.—About 4 miles S.E. by E. $\frac{1}{2}$ E. from Lem Phan Va, the south-east point of Junkseylon, is Goh Mai Tan (*Malay* Pulo Bambu) ; a narrow island, $1\frac{1}{2}$ miles long, of moderate height and covered with trees. At one cable off its south point lies a group of rocks partly visible, with deep water close to them. The north-east coast of this island forms a sandy bay, which affords some shelter in the south-west monsoon, in depths of 6 and 7 fathoms. The north point is low and sandy having a rock, which is always visible, off the extreme. Within half a mile of this island are depths of from 10 to 15 fathoms all round it.

Goh Dakmai, a high, square, almost perpendicular island, lies N.E. by E. $\frac{1}{2}$ E. from the north point of Goh Mai Tan, and there is deep water round it. There is a safe channel for vessels coming from the south-east and bound to Puket, to the south of Goh Gai, and then in between Goh Mai Tan and Goh Dakmai.

Goh Khai Nok is a small, low, sandy island, lying in the channel between Pulo Panjang and Junkseylon, about 5 miles E.N.E. from Lem Atpha, and has a bluff on the south side, covered with trees ; it is surrounded with rocks to a distance of about three-quarters of a mile, of which two patches are visible, the one north-westward, the other south-eastward of the island.

Goh Khai Noi is smaller and lower than Khai Nok, from which it is separated by a channel $2\frac{1}{4}$ miles broad, with depths of 10 and 12 fathoms. This island is surrounded by rocks, which do not, however, extend far out.

Goh Sob (*Sisters*) are two small, high perpendicular rocks, about $3\frac{1}{2}$ miles N. by E. from Goh Lipe (a conical rock more than 100 feet high), and about one mile off the coast of Goh Jao Jai (Pulo Panjang); there is deep water all around them.

PULO RAJAH (*Saya*).—This island, situated 5 miles N. by E. $\frac{3}{4}$ E. from North Brother island, rises to a height of 1,064 feet in the south-western parts, while the north-east side is low.

Gulnare cove, at the north-west point, is about half a mile long by a quarter of a mile wide, having a depth of 9 fathoms, sand, in the centre. There is another small inlet on the north side of Pulo Rajah, where a stream empties itself.

Overfalls.—There are heavy overfalls between Pulo Rajah and the Brothers islands.

BROTHERS ISLANDS, situated about 15 miles southward of Junkseylon, are densely wooded, steep-to, and nearly connected by a reef. The northern island, 517 feet high, has a detached rock lying $3\frac{1}{2}$ cables off the north extreme. The southern island, 239 feet high, is of nearly uniform height on the summit; a reef extends about one cable from its south point.

Currents.—Southward of Junkseylon during the north-east monsoon the current sets N.W.; during the south-west monsoon it sets S.E., but if the wind has been strong from west or W.N.W., the current will run nearly east, southward of the Brothers island.

MONEY, WEIGHTS AND MEASURES.

The Gold coin is the *Mohur* = 16 Rupees. The current money is one Rupee = 16 annas ; 1 anna = 12 pie.

The weight of the Gold Mohur and that of the current Rupee is the same, *viz.*, 180 grains troy. Sicca Rupees are referred to in the Money Market, but not issued ; 100 Sicca Rupees are equal to 106-10-8 current Rupees.

To convert Sicca Rupees into current, add $\frac{1}{5}$ th ; and current Rupees into Sicca, deduct $\frac{1}{6}$ th.

Bazár Weight.—16 Chittacks = one seer, or 2 lbs. 0 oz. 13 drs. ; 40 seers = 1 maund, or 82 lbs. 2 ozs. 3 drs. ; 100 Bazar maunds = 110 Factory ; $1\frac{1}{2}$ Factory maunds = 1 cwt.

Factory Weight.—16 Chittacks = 1 seer, or 1 lb. 13 ozs. 14 drs. ; and 40 seers = 1 maund, = 74 lbs. 10 ozs. 14 drs. The Indian maund = $82\frac{2}{3}$ lbs. Avoirdupois Weight.

BRITISH INDIAN MONEY :—

1 Pie -	-	-	-	marked P.	=	The values in English money vary with the price of silver.
3 Pie -	-	make 1 Pice -		„ Ps.	=	
8 Pie -	-	-	-		=	
4 Pice or 12 Pie	„	1 Anna		„ A.	=	
16 Annas	-	„ 1 Rupee		„ R.	=	
16 Rupees	-	„ 1 Gold Mohur		„ G.M.	=	

Cowries (*Cypræa moneta*), or small shells, are also made use of for fractional payments. Their value is subject to fluctuations. They are reckoned in Bengal :—

4 Cowries -	-	-	-	-	make 1 Gunda.
20 Gundas -	-	-	-	-	„ 1 Pun.
5 Puns -	-	-	-	-	„ 1 Anna.

BRITISH INDIAN WEIGHT :—

The following are the weights in general use.* The unit is the Tola, equal to 180 grains English Troy Weight. From it, upwards, are derived the heavy weights, *viz.*, *Chittack*, *Seer*, and *Maund* ; and by its subdivision, the small or jeweller's weights called *Mashas*, *Ruttis*, and *Dhans*.

* By the Indian Weights and Measures of Capacity Act, 1871, it is enacted throughout British India the *Seer* or *Ser* shall be the primary standard of weight, and that it shall be equal, when weighed in a vacuum, to the weight known in France as the *Kilogramme des Archives*. The units of weights and of measures of capacity shall be for Weights, the said *Seer* ; for measures of capacity, a measure containing one such *Seer* of water at its maximum density, weighed in a vacuum.

The following Table gives both the series :—

1 Dhan or } grain }	-	=	$\frac{1}{32}$	grain Troy =	$\frac{3}{178}$	dr. Avoir.
4 Dhans = 1 Rutti	=	$1\frac{1}{8}$	"	=	$\frac{17}{8}$	"
8 Ruttis = 1 Masha	=	15	"	=	$\frac{96}{375}$	"
12 Mashas = 1 Tola	=	7 dwt. 12	"	=	$6\frac{10}{175}$	"
5 Tolas = 1 Chittack	=	1 oz. $17\frac{1}{2}$ dwt. Troy	=	$2\frac{2}{3}$	oz.	"
16 Chittacks = 1 Seer	=	$2\frac{1}{4}$ lbs. Troy	=	$2\frac{2}{3}$	lbs.	"
40 Seers = 1 Maund	=	100 lbs. Troy	=	$82\frac{2}{7}$	lbs.	"

The Maund is equal to 100 English pounds Troy, and 35 Seers are equal to 72 pounds Avoirdupois.

To convert Indian Weight into Avoirdupois.—Multiply the weight in Seers by 72, and divide by 35; the result will be the weight in lbs. Avoirdupois. Or, multiply the weight in Maunds by 36, and divide by 49; the result will be the weight in cwt. Avoirdupois.

To convert Avoirdupois Weight into Indian Weight.—Multiply the weight in lbs. Avoirdupois by 35, and divide by 72; or multiply the weight in cwt. by 49, and divide by 36; the result will be the weight—in the former, in Seers—in the latter in Maunds.

A Ton is equal to 27·222 Maunds, or $27\frac{1}{4}$ Maunds nearly.

BAZÁR WEIGHT.

5 Sicki or Quarter	To reduce Bazár weight into
Rupee make - 1 Cancha.	cwt., add 1-10th and deduct 1-3rd
4 Cancha make - 1 Chittack.	of that sum, the remainder will
4 Chittacks, or 20	be cwt.
Tolas make - 1 Powá.	Thus ; 3,000 { Bazár
4 Powás make - 1 Seer.	Maunds.
5 Seers make - 1 Pusserí.	Add 1-10th 300
8 Pusserís, or 40	3,300
Seers make - 1 Maund.	Deduct 1-3rd 1,100
To reduce Bazár weight into	Remainder 2,200 Cwt.
Factory weight, add 1-10th.	To reduce Factory Maunds into
Thus ; 3,000 Bazár Maunds.	Tons, divide by 30, and the quo-
Add 1-10th 300	tient will be the answer.
—	Thus ; Factory Maunds $3,000 \div$
3,300 Factory Maunds	$30 = 100$ Tons.

The kilogramme equals 15432·34880 grains ; 32·150727 ounces, Troy ; 2·2046213 pounds avoirdupois ; 0·01968412 cwt. of 112 lbs. ; 0·000984206 ton of 20 cwt.

One hundredweight of 112 lbs. equals 50·80237689 kilogrammes ; 1 lb. avoirdupois 0·45359265 kilogramme ; 1 ounce, troy, 31·103496 grammes ; 1 grain 0·064798950 gramme.

LINEAL MEASURE.—Though the cubit or human forearm is the basis or unit in Oriental and Western countries, there is no fixed standard established in India.

In Bengal the measure generally used is the following :—

1 Hath (Cubic)	- - -	=	18 inches.
4 Haths	= 1 Danda (or Bam)	=	2 Yards.
1,000 Dandas	= 1 Coss (or Kos)	=	2,000 „

The Coss or Bengal mile is equal to 1 mile, 1 furlong, 3 poles, $3\frac{1}{2}$ yards, English.

In the North-west Provinces, the average length of the coss is about 2 miles ; but it differs in almost every province in the country. For instance, in Agra and Muttra, it is about $1\frac{3}{4}$ miles ; towards the Hills the coss is a little more than a mile ; while in Bundelcund it is three times as long as in other parts, and is called a *Páka Coss*.

GLOSSARY

OF A FEW TERMS USED IN CHARTS AND SAILING DIRECTIONS.

Numerous languages and dialects are embraced on the various coasts treated of in the Bay of Bengal Pilot. On the south-west and south coast of Ceylon, Sinhalese is the language ; on the north and east coasts of the same island, Tamil. Around the coast of Palk bay, Tamil or Malayalam is the language ; advancing north, this gives way to Hindustáni, which again, as the north-west part of the bay is approached, is superseded by Bengali. On the east coast of the bay of Bengal Arakanese is spoken, Burmese, and further to the south, Malay. The language of the Nicobar islands consists of various dialects spoken at different islands of the group, none of which have been written ; that of Kar Nicobar is the best known. In the south part of the Andaman islands efforts have been made of late years to construct a dictionary of the native language, but the dialects here again are many, and progress in this respect has been slow.*

* See List of Andamanese names by Mr. E. H. Man and Lieut. R. C. Temple in the Royal Geographical Society's Journal for 1880, p. 256, 259.

English.	Hindustáni.	Bengali.	Burmese.	Malay.
Mountain or hill.	Giri ; pahár (par).-	- -	Taung -	Gunong.
Island - -	Jinjira ; díp ; lanka	- -	Gyun -	Pulau ; Pulo.
River - -	Kári -	- -	Myit -	Batang, Sung-ei.
Creek - -	Nadi ; nullah -	Khal -	Chaung -	Jurang, churang.
Opening - -	- -	- -	Wa -	Lapong.
Village - -	Chota Gam -	- -	Yua -	Kampong.
Town - -	Bara Gam -	- -	Myo ; Daung	Negri.
Communication	- -	- -	Galit.	
Pagoda - -	- -	- -	Kyaung.	
Lake - -	- -	- -	In -	Danau ; tasek.
Point - -	Karú -	- -	- -	Ujong ; Tanjong.
Sandbank -	Balu Danda-	Char -	- -	Beting.
Market town -	- -	Ganj -	- -	Pakau ; pasar.
Small - -	- -	- -	Nge -	Kechil.

English.	Sinhalese.	Tamil.
Mountain hill - -	Kanda-hela gala - -	Malái.
Rock - -	Gala-gal - -	Kallú kal.
Bay - -	Kudáwá - -	Kudá.
Harbour - -	Waráya - -	Turai muka.
Custom house - -	Riguwa - -	Paku, or Aluppanti.
Provisions - -	Ahara - -	Jin Chàmàn.
Doctor - -	- -	Dakuttai.
Boat - -	Oruwa - -	Toni vallam Kattai.
Cargo - -	Petawili - -	Chàmàn.
River - -	Ganga, or Oya - -	Aru, or Ar.
Mouth of river - -	Modara, Tota, Taru - -	Mukattuvaram.
Surf - -	Rela, or Ratè - -	Alai, or Kaddal.
Seashore - -	Werala - -	Kadat Karai.
Tree - -	Gaha, Ruka - -	Maram.
Flagstaff - -	Kodi gaha - -	Kodi Maram.
House - -	Geya, gè - -	Vèdu.
Hut - -	Pela - -	Kudil.
Point - -	Indawa - -	Munai.
Jungle - -	Kèlè - -	Kādu.
Wind - -	Hulanga - -	Kattu.
North wind - -	Uturu hulan.	
South wind - -	Dakunu hulan.	
Sea breeze - -	Mutu hulan.	
Land wind - -	Goda-hulan.	
Rocky point - -	- -	Kāl Mūnai.
Rocky bay - -	- -	Kāl Kūda.

MARINER'S COMPASS.

English.	Hindustáni.	Bengali.	Malay.	Burmese.
North -	Gí - - -	Úttá - - -	Útára - - -	Miauk.
N. by E. -	Gí wíjau choki -	Úttá ek nishan kona -	_____	_____
N.N.E. -	Gí wíjau tír - -	Úttá do nishan kona -	Útára sa-máta timor	_____
N.E. by N. -	Gí wíjau tír wíjau choki	Úttá tín nishan kona -	_____	_____
N.E. -	Gí wíjau arkrop -	Nishan kona - -	Timorlaut or útára Timor.	Ashi Miauk.
N.E. by E. -	Gí wíjau arkrop wíjau choki.	Mutlu tín nishan kona	_____	_____
E.N.E. -	Mutlí dau tír -	Mutlu do nishan kona -	Timor sa-máta útára	_____
E. by N. -	Mutlí dau choki -	Mutlu ek nishan kona -	_____	_____
East -	Mutlí - - -	Púrúb mutlu - -	Timor or timor tapat	Ashi.
E. by S. -	Mutlí wíjau choki -	Mutlu ek súlí mutlu -	_____	_____
E.S.E. -	Mutlí wíjau tír -	Mutlu do súlí mutlu -	Timor tangára or menoungára.	_____
S.E. by E. -	Súli dau arkrop dau choki.	Mutlu tín súlí mutlu -	_____	_____
S.E. -	Súli dau arkrop -	Sulí mutlu - -	Tangára or menoun- gára.	Ashi-Taung.
S.E. by S. -	Súli dau arkrop wíjau choki.	Sulí tín sulí mutlu -	_____	_____
S.S.E. -	Súli dau tír - -	Sulí do sulí mutlu -	Salátan menoungára	_____
S. by E. -	Súli dau choki -	Sulí ek sulí mutlu -	_____	_____
South -	Súli - - -	Sulí - - -	Salátan - - -	Taung.
S. by W. -	Súli wíjau choki -	Sulí ek sulí kiblú -	_____	_____
S.S.W. -	Súli wíjau tír -	Sulí do sulí kiblú -	Salátan dáya -	_____
S.W. by S. -	Súli wíjau arkrop dau choki.	Sulí tín sulí kiblú -	_____	_____
S.W. -	Súli wíjau arkrop -	Sulí kiblú ukurub -	Bárat dáya - -	AnautTaung.
S.W. by W. -	Súli wíjau arkrop wíjau choki.	Kiblú tín sulí kiblú -	_____	_____
W.S.W. -	Kablí dau tír -	Kiblú do sulí kiblú -	Bárat sa-máta salátan	_____
W. by S. -	Kablí dau chokí -	Kiblú ek sulí kiblú -	_____	_____
West -	Kablí - - -	Kiblú - - -	Bárat or bárat tapat	Anaut.
W. by N. -	Kablí wíjau choki -	Kiblú ek agní kona -	_____	_____
W.N.W. -	Kablí wíjau tír -	Kiblú do agní kona -	Bárat sa-máta útára	_____
N.W. by W. -	Gí dau arkrop dau choki.	Agní kona - -	_____	_____
N.W. -	Gí dau arkrop -	Agní kona - -	Bárat laut - -	AnautMiauk.
N.W. by N. -	Gí dau tír dau choki	Úttá tín agní kona -	_____	_____
N.N.W. -	Gí dau tír - -	Úttá do agní kona -	Útára bárat laut -	_____
N. by W. -	Gí dau choki -	Úttá ek agní kona -	_____	_____

**Monthly Statement of Currents and Winds
on the Coasts of Ceylon, as experienced
in 100 Voyages round that Island by Mr.
Thomas Robson, Commander of the
Colonial Government Steamer "Seren-
dib," during the five years July 1881 to
September 1886.***

* The results given for the months are the averages of the five years 1881-6.

MONTHLY STATEMENT OF CURRENTS AND WINDS on the COASTS of CEYLON.

JANUARY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pamban.	Knots per Hour. 4	N.N.W.	Strong	N.N.E.	Moderate	The prevailing winds are from north to north-east, moderate in the morning and stronger in the afternoon. The weather is generally fine.
Between Pamban and Jafna.	1 to 2	Tidal ebb northerly, flood southerly.	Strong	N.E.	Moderate	The tidal stream sets through between the islands, the ebb in a northerly and flood in a southerly direction. The north-east winds are strong with a nasty short chopping sea, but fine weather is found in the bay.
Between Jafna and point Pedro.	1 to 2	Tidal ebb easterly, and flood westerly.	Strong	N.E.	High	On the north coast the north-east winds are strong and a high turbulent sea, especially on the ebb tide. The flood tide is very strong at times.
Between point Pedro and Trincomali.	14	S.E.	Moderate	N.E.	Moderate	The weather is in general cloudy and squally with rain, but fine weather is experienced towards the end of the month.
Between Trincomali and Batticaloa.	14	S.E.	Moderate	Northerly	Moderate	There is a very strong outset from the rivers at Trincomali and the Virgel and Valachchenai and Arrokgain when there are heavy rains up country; this causes a very rough sea at times on the coast.
Between Batticaloa and Little Basses.	2	S.S.W.	Fresh	N.E.	High	The north-east winds are very strong and the sea rough, and just outside the range of the Little Basses to the eastward the current sets strong to the S.S.E.
Between Little Basses and Hambantotti.	24	S.W.	Strong	N.E.	High	The north-east wind is strong as far as Hambantotti, but the sea is more regular than on the east coast; the current runs very strong to the west-south-west.
Between Hambantotti and Galle.	14	W.S.W.	Strong	N.E.	Moderate	Between Hambantotti and Galle the wind and sea are more moderate and the current less with fine clear weather.
Between Galle and Colombo.	4	N.N.W.	Light	N.N.E.	Moderate	The winds between Galle and Colombo are from N.N.W. to N.N.E. Sometimes a squall from the east, but the weather is generally fine and clear.

MONTHLY STATEMENT OF CURRENTS and WINDS on the COASTS of CEYLON—*continued*.

FEBRUARY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	North-westerly.	Fresh	N.E.	Moderate	The prevailing wind is N.N.E. blowing fresh with clear weather and moderate sea. The sea is very smooth at the head of the gulf.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly, flood southerly.	Fresh	N.E.	Smooth	Fresh N.E. winds and clear with smooth water except on the flood tide and south-east winds. On the ebb tide with a strong northerly wind which causes a short chopping sea very bad for small vessels.
Between Jafna and point Pedro.	1 to 2	Tidal ebb easterly, flood westerly.	Fresh	N.E.	Moderate	The winds are inclined more easterly and clear weather with moderate sea, except on the ebb tide.
Between point Pedro and Trincomali.	1	N.W.	Light	N.E.	Smooth	Moderate E.S.E. to N.E. winds and clear weather with a moderate sea; near Trincomali calms and light variable winds prevail at times.
Between Trincomali and Batticaloa.	‡	S.S.E.	Moderate	N.E.	Smooth	Moderate easterly winds and clear with moderate sea, but at times there is a heavy swell from the N.E. causing a heavy surf on the bar at Batticaloa.
Between Batticaloa and Little Basses.	‡	S.S.E. to S.S.W.	Moderate to fresh.	N.E. to East.	Moderate	Light N.N.E. winds and fine weather with a moderate sea.
Between Little Basses and Hambantotti.	1½	W.S.W.	Fresh	N.E. to East.	Moderate	Moderate easterly winds and clear, and on a few occasions there are squalls of wind and rain from the land.
Between Hambantotti and Galle.	1	W.S.W. to W.N.W.	Moderate	N.E.	Moderate	Light winds from E.S.E. to N.N.E. and fine clear weather with smooth water.
Between Galle and Colombo.	‡	N.N.W.	Moderate	Northerly	Smooth	At the beginning of the month light N.E. breezes and cloudy, but at the end of the month the wind becomes variable with occasional showers at night when the land wind comes off shore.

MONTHLY STATEMENT OF CURRENTS AND WINDS on the COASTS of CEYLON—*continued*.

MARCH.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. $\frac{1}{2}$ to $\frac{3}{4}$	N.W.	Moderate	North to N.E.	Smooth	Moderate north and N.E. winds and fine weather with passing showers of rain. Very hot sultry weather and hazy over the land.
Between Pambam and Jafna.	Tidal $1\frac{1}{2}$ to $2\frac{1}{2}$	Tidal ebb northerly and flood southerly.	Light	Variable	Smooth	Light variable winds and calms. The weather is fine but very hazy at times.
Between Jafna and point Pedro.	Tidal $1\frac{1}{2}$ to $2\frac{1}{2}$	Tidal ebb easterly and flood westerly.	Light	N.E.	Smooth	The prevailing wind is north-east, but light variable winds and calms are the rule.
Between point Pedro and Trincomali.	$\frac{1}{2}$ to 1	N.N.W.	Light	N.E.	Smooth	Light north-east and easterly winds, but they are very unsteady. The weather is fine.
Between Trincomali and Batticaloa.	1 to $1\frac{1}{2}$	N.N.W.	Light	E.S.E.	Smooth	Light variable winds and fine weather. The prevailing winds are easterly. Very hazy over the land.
Between Batticaloa and Little Basses.	$\frac{1}{2}$ to $\frac{3}{4}$	N.N.E.	Light	Land and sea breezes.	Smooth	Light variable land and sea breezes. Very cloudy over the land.
Between Little Basses and Hambantotti.	$\frac{1}{2}$ to $\frac{3}{4}$	Westerly	Light	East to N.E.	Smooth	Light land and sea breezes; the prevailing winds are from the eastward. The currents are very slight and set with the wind generally.
Between Hambantotti and Galle.	$\frac{1}{2}$ to $\frac{3}{4}$	Westerly	Light	N.E. and S.W.	Smooth	Light variable winds and fine weather. Very cloudy appearance over the land.
Between Galle and Colombo.	No current		Light	Variable	Smooth	Light unsteady winds and cloudy hazy weather. It is also very close, hot, sultry weather, with dark clouds over the land at times.

MONTHLY STATEMENT OF CURRENTS AND WINDS on the COASTS of CEYLON—*continued*.
APRIL.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ½ to ¾	Northerly	Light	S.W.	Smooth	The winds are light and very unsteady. Very hot sultry weather. Land and sea breezes at times.
Between Pambam and Jafna.	Tidal 1½ to 2½	Tidal ebb northerly and flood southerly.	Light	South to S.E.	Smooth	Light variable winds. Land and sea breezes. Very close, hot, sultry weather.
Between Jafna and point Pedro.	Tidal 1½ to 2½	Tidal ebb easterly and flood westerly.	Light	Variable	Smooth	Light variable winds, mostly from the southward. Very hot, sultry weather.
Between point Pedro and Trincomali.	1½ to 2½	N.W.	Light	Variable and easterly.	Smooth	Light easterly and variable winds, and calms with fine clear weather.
Between Trincomali and Batticaloa.	½ to 1	N.N.W.	Light	Variable and easterly.	Smooth	Light easterly winds and calms. Very hazy over the land, but fine weather.
Between Batticaloa and Little Basses.	½ to ¾	N.N.E.	Light	Land and Sea breezes.	Smooth	Light S.E. and variable winds. Very fine weather. Hazy over the land.
Between Little Basses and Hambantotti.	½ to ¾	Westerly	Light	N.E. to East	Smooth	Light S.E. winds, sometimes calm and variable. Very cloudy over the land, with occasional showers of rain.
Between Hambantotti and Galle.	½ to ¾	Westerly	Light	N.E. to S.W.	Smooth	Light variable winds, mostly from the southward. Sometimes calms prevail with very hot sultry weather.
Between Galle and Colombo.	No current		Light	Variable	Smooth	Light variable winds and calms. Very hot sultry weather during the day time with light showers at night. Very cloudy over the land.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

MAY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. 4	N.N.E.	Strong	S.W.	High sea	Winds mostly S.W. unsteady at times squally with rain, and gale some-time sets in, beginning at south and ending W.S.W., the squalls heavy.
Between Pambam and Jafna.	Tidal 1½ to 2	Current. S.E. & N.W.	Brisk	S.W. to S.	Smooth	The weather is very uncertain with occasional spells of squally weather; had a strong W.S.W. gale in 1886, being the S.W. verge of a cyclone at Madras.
Between Jafna and point Pedro.	Tidal 1½ to 2	Current E. & W.	Light to fresh.	S.W.	Smooth	The prevailing winds are from S.W. with light variable winds at times. A gale or cyclone in the Bay of Bengal sends in a heavy easterly swell on the north coast of Ceylon.
Between point Pedro and Trincomali.	1½	N.N.W.	Fresh	S.W.	Smooth	Generally fresh S.W. winds and fine weather, and smooth sea. In 1886 when anchored on the Muletiru shoals on two different occasions I found a current setting 2½ knots to the N.W.
Between Trincomali and Batticaloa.	Nil	Nil	Moderate	E.S.E. & W.N.W.	Smooth	Between Trincomali and Batticaloa land and sea breezes prevail A.M. from the west, and P.M. E.S.E. The weather is fine with squalls over the land at times, with much lightning and thunder to the westward.
Between Batticaloa and Little Basses.	1½	N.N.E.	Strong	S.W.	Moderate	From Batticaloa to about 20 miles south land and sea breezes prevail, with fine weather and smooth water. From Karatiru strong S.W. winds prevail with a high southerly sea, much lightning and thunder over the land. May 1886 had a one-knot current setting S.S.W., very exceptionable.
Between Little Basses and Hambantotti.	1½	E.N.E.	Strong	S.W.	Moderate	Between Hambantotti and Little Basses the prevailing winds are S.W., strong and squally at times.
Between Hambantotti and Galle.	1	Easterly	Strong	S.W.	Moderate	The S.W. monsoon begins about the middle of the month and is strong and squally at times with a high southerly swell.
Between Galle and Colombo.	1	Southerly	Moderate	S.W.	Moderate	Is the same, but the swell is from W.S.W., and when the current crosses this swell it causes a very high turbulent sea.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

JUNE.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. $\frac{1}{2}$	Northerly	Fresh	S.W.	High sea	Strong S.W. monsoon with occasional spells of squally, cloudy, rainy weather. I always find the strongest winds and most turbulent sea right across the gulf about half way between Colombo and Pambam.
Between Pambam and Jafna.	$1\frac{1}{2}$ to 2	Tidal S.E. & N.W.	Fresh	S.W.	Smooth	Weather generally fine but hazy with a few squalls occasionally; the weather as a rule is altogether better than in the Gulf of Manaar.
Between Jafna and point Pedro.	$1\frac{1}{2}$ to 2	E. & W.	Fresh	S.W.	Smooth	Weather generally fine, the wind veers to the southward during the night.
Between point Pedro and Trincomali.	$\frac{1}{2}$	N.N.W.	Fresh	S.W.	Smooth	Fine weather, hazy at times, fresh land winds from W.S.W. and S.W., sea smooth. Small sailing vessels make a passage either up or down the coast quite easily.
Between Trincomali and Batticaloa.	None	None	Fresh	W.S.W.	Smooth	Fresh westerly winds from Trincomali to Vendell Bay, generally westerly winds at Batticaloa from 8 p.m. to 10 a.m., calm at midday and light E.S.E. sea breeze in afternoon.
Between Batticaloa and Little Basses.	$\frac{1}{2}$	Southerly	Fresh	S.W.	High sea	From Batticaloa to 30 miles south light land wind in the night and sea breeze S.E. in the afternoon. From Agamis to Little Basses nearly always southerly and S.W. winds often increasing to a gale in the afternoon with very high cross sea caused by a slight southerly set of current as far as Little Basses.
Between Little Basses and Hambantotti.	Nil	Nil	Fresh	W.S.W.	High sea	The sea and wind always moderates when near Hambantotti. A thick haze generally over the land.
Between Hambantotti and Galle.	1	E. & E.N.E.	Fresh	W.S.W.	High sea	Squalls with rain, occasionally with high turbulent sea, generally cloudy weather and hazy over the land; the strength of the current depends on the strength of the wind; there is always a long southerly swell.
Between Galle and Colombo.	$\frac{1}{2}$	Southerly	Moderate	W.S.W.	Moderate	There is always a heavy S.W. swell, the wind varies from S.W. west and W.S.W. blowing fresh at times. The current generally sets to the S.S.E. between Kallura and Galle. It often happens that if Galle light is not sighted, that all vessels find themselves a long way south of their reckoning.

MONTHLY STATEMENT OF CURRENTS and WINDS on the COASTS of CEYLON—continued.
JULY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. $\frac{1}{4}$	Northerly	Fresh	S.W.	Moderately high	There are generally fresh breezes and cloudy hazy weather during the month in the gulf of Mannar; the wind moderates when near the head of the gulf in the morning, but blows very strong again in the afternoon.
Between Pambam and Jaina.	Tidal current. 1 to 2	S.E. and N.W.	Moderate	S.W.	Smooth	The S.W. winds prevail, but occasionally S.E. and N.W. are experienced when the weather is settled and fine. The sea is smooth, but in strong afternoon breezes it gets very turbulent and short chopping sea, when the tides are setting against the wind, very bad for small boats.
Between Jaina and point Pedro.	Tidal. 1 to 2	E. and W.	Moderate	W.S.W.	Smooth	W.S.W. winds prevail during the day time, veering to the southward at night, and is rather gusty at times.
Between point Pedro and Trincomali.	1	N.N.W.	Fresh	S.W.	Smooth	The westerly or land winds prevail, with smooth sea. The current is much stronger when near Muletiro shoals, which I found on each trip I made when attending upon the salvage party at the wreck of the P. & O. S.S. " <i>Indus</i> ."
Between Trincomali and Batticaloa.	None	None	Moderate	S.W.	Smooth	Strong land winds and smooth water between Trincomali and Vendelüs, but from Vendelüs to Batticaloa the land wind blows from about 10 p.m. until the next noon, then generally a S.E. sea breeze sets in. It is squally in the evening sometimes.
Between Batticaloa and Little Basses.	$\frac{1}{4}$	Southerly	Moderate	S.W.	Moderate	From Batticaloa the wind is from the westward in the morning and S.E. in the afternoon as far as Aganis. Between Aganis and Little Basses the southerly and S.W. winds are very strong, with a high sea, caused by a slight southerly set of current; it is very hazy over the land.
Between Little Basses and Hambantotti.	1	E.N.E.	Fresh	S.W.	High	The wind and sea moderates when near Hambantotti.
Between Hambantotti and Galle.	$\frac{1}{4}$	Easterly	Fresh	W.S.W.	High	The prevailing winds are west and W.S.W., moderate during the night, light in the mornings, and strong in the afternoon: the southerly swell is constant and heavy. A strong westerly wind causes a cross sea, and the current increases. It is always hazy over the land, and is very deceiving in judging distances. The weather is squally, with rain at times.
Between Galle and Colombo.	Slight	Southerly	Moderate	W.S.W. to W.N.W.	Moderate	The prevailing winds are from west and W.S.W.; the afternoon winds are generally the strongest, there are occasional squalls of wind and rain. When the wind is strong from the westward there is generally a very high cross sea. It is hazy and cloudy over the land, especially in the early morning.

MONTHLY STATEMENT of CURRENTS and WINDS on the COASTS of CEYLON—continued.
AUGUST.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. 4	Northerly	Fresh	W.S.W.	High	The prevailing winds are from S.S.W. to W.S.W., with generally fine weather, but there are occasional squalls with heavy rain. There is always a heavy swell from the W.S.W., and I always find there are stronger winds and more sea about half way between the two ports than there is when near either of them.
Between Pambam and Jafna.	1½ to 2	Tidal ebb northerly and flood southerly.	Strong	S.W.	Smooth	The wind generally shifts from S.W. to south when leaving Pambam, but the prevailing wind is S.W., fresh, with sudden gusts.
Between Jafna and point Pedro.	1½ to 2	Tidal ebb easterly and flood westerly.	Fresh	S.W.	Smooth	The prevailing wind on the North Coast is from W.S.W. to south; it is generally very strong and puffy, in the day time W.S.W., and veering to the southward at night, similar to land and sea breezes. At anchor off Kankasentorai the tides are very regular.
Between point Pedro and Trincomali.	1 to 2	N.W.	Fresh	W.S.W.	Smooth	The prevailing winds are from W.S.W., blowing very fresh at times. The currents are not steady, for in August 1885 and 1886 I had a 2½-knot current setting to the N.W. The weather is fine, but hazy over the land.
Between Trincomali and Batticaloa.	4	Northerly	Fresh	W.S.W.	Smooth	The prevailing winds are from W.S.W., blowing fresh from Trincomali as far as Vendelus Bay, where it drops suddenly at mid-day, and a light southerly or S.E. wind sets in and continues until sunset. At Batticaloa it is the same, and at 10 p.m. the wind comes off the land. It falls calm in the early morning.
Between Batticaloa and Little Basses.	1	N.N.E.	Fresh	S.W.	High	Light land and sea breezes from Batticaloa to Kalmuni, and from Kalmuni to the Little Basses the S.S.W. wind is very strong in the afternoon, with a heavy southerly swell, and sometimes the current sets S.S.W. 1 knot per hour, which causes a very high turbulent sea. This also continues the same as far as Hambantotti, where it gets more moderate.
Between Little Basses and Hambantotti.	1	E.N.E.	Fresh	S.W.	High	The winds and weather are the same from the Little Basses to Hambantotti. The prevailing wind is from W.S.W.; the weather is hazy and cloudy, with occasional squalls of wind and rain. The heavy S.W. swell is constant, and when the wind is strong from W.S.W. to west there is a very high sea.
Between Hambantotti and Galle.	4	Easterly	Fresh	W.S.W.	High	The prevailing winds are from S.W. and W.S.W., although it hails as far as W.N.W. at times; the afternoon breeze is the strongest; there are occasional spells of rain and squalls, with a very heavy S.W. swell. The current sets past Point de Galle to the S.S.E. Ships are often drifted off the land while lying-to waiting for daylight to go into Galle harbour.
Between Galle and Colombo.	1	S.S.E.	Fresh	S.W. by W.	High	

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—*continued*.
SEPTEMBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pamban.	Knots per Hour. ‡	Northerly	Fresh.	W.S.W.	High	The prevailing winds are from S.W. to west and blow fresh with a high turbulent sea. Weather fine but hazy. The wind is strongest about half way between Colombo and Pamban.
Between Pamban and Jafna.	1 to 2	Tidal ebb northerly, flood southerly.	Moderate	S.S.E.	Smooth	
Between Jafna and point Pedro.	1 to 2	Tidal ebb easterly and flood westerly.	Moderate	South to W.S.W.	Smooth	The wind north of Rameswarum is generally from the S.S.E. Moderate and fine weather, hazy at times with lightning to the N.E. The direction of tides is variable through the islands in the bay.
Between point Pedro and Trincomali.	‡	Southerly	Fresh	S.W.	Smooth	During the day the wind is from W.S.W., but during the night from S.S.W. and very puffy off shore at times. It is generally very cloudy to the westward.
Between Trincomali and Batticaloa.	No current		Moderate	S.W. to S.E.	Moderate	
Between Batticaloa and Little Basses.	1	S.S.W.	Light to fresh.	S.E. to S.W.	Moderate to high	The winds are very unsteady, but mostly fresh W.S.W. with squalls and rain at times. The weather begins to get cloudy over the land with lightning. The winds are fresh about Trincomali from S.W. to W.S.W. with clear weather. Sometimes a smart squall of wind and rain. The wind nearly always falls light off Batticaloa with land winds from W.S.W. at night and S.E. in the afternoon. This continues about 20 miles south of Batticaloa.
Between Little Basses and Hambantotti.	1‡	E.N.E.	Fresh	S.W.	High	On the S.E. coast near the Little Basses the S.W. winds are very strong in the afternoon, and the current setting against the wind and the usual southerly swell causes a high turbulent sea off the Great Basses. It is more moderate after midnight.
Between Hambantotti and Galle.	‡	Easterly	Moderate	W.S.W.	High	I find the P.M. winds always fresh and the A.M. very moderate between the Little Basses and Hambantotti. The weather is hazy, especially over the land and is very deceiving in judging distance off shore. In 1885 when attending upon the Basses lighthouses I found the current very strong inside the reefs setting to the E.N.E. (sometimes squally with rain, but very seldom). This E.S.E. current meeting the S.S.W. current causes a set to the S.E. off the Little Basses, many vessels are drifted to S.E. thereby.
Between Galle and Colombo.	Slight	Southerly	Moderate	West	High	On the south coast fresh W.S.W. winds, high sea and hazy weather. It is generally cloudy and squally off Point de Galle and very hazy to W.N.W. fine weather, hazy over the land, the heavy S.W. swell continues throughout September. The weather is always better when near Colombo.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

OCTOBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. No current		Moderate	S.W. west, N.N.E., S.S.W. to N.N.E.	Moderate	In October the winds and currents are variable with cloudy unsettled weather, sometimes heavy squalls of wind and rain. The current generally sets with the wind when it is fresh. The sea is moderate, very hazy over the land.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly, and flood southerly. Tidal do.	Light	variable.	Smooth	In the first part southerly winds and fine weather prevail, in the latter part northerly winds prevail bring cloudy weather with occasional squalls of rain from the N.E. The sea also begins to get up in Palk straits off Karatira and the north coast off Kanakas-en-forai.
Between Jafna and point Pedro.	1 to 2	Tidal do.	Moderate	S.S.W., west, N.N.E., W.S.W. to N.N.E.	Moderate	The same remarks apply to the coast as far as Point Pedro. At the end of the month the weather is dull and cloudy with very hard squalls of wind and rain from N.E. with a high sea.
Between point Pedro and Trincomali.	Slight to $\frac{2}{4}$	S.S.E.	Fresh	W.S.W. to N.N.E.	Moderate	In the first part the winds are moderate from W.S.W. with fine but cloudy weather with moderate sea. In the latter part the weather begins to get unsettled and cloudy with thick squally rainy weather, the wind is unsteady from S.W. and N.W. to north and N.E. with high N.E. sea, and the current runs strong to the S.S.E.
Between Trincomali and Batticaloa.	Slight to $\frac{1}{4}$	S.S.E.	Fresh to light.	W.S.W. to S.S.E.	Smooth to moderate.	In the first part fresh W.S.W. winds prevail about Trincomali as far as Ven-de-lus bay, and at Batticaloa bay land and sea breezes with fine weather, but in the latter part the wind and weather becomes very unsettled with cloudy, rainy squally weather, much lightning to the N.E. and east, very hazy over the land.
Between Batticaloa and Little Basses.	$\frac{1}{2}$ to 2	S.S.W.	Fresh to light.	S.W. to easterly.	Moderate	In the first part the land and sea breezes prevail about Batticaloa, but near the Little Basses fresh S.W. winds prevail in the afternoon and the current is weak, but at the end of the month it runs 2 knots to the S.S.W. and the weather begins to get unsettled and the wind from S.W. to East. Sometimes rainy squally weather from the N.W.
Between Little Basses and Hambantotti.	Slight to $\frac{1}{4}$	W.S.W.	Moderate	S.W. to N.W.	Moderate	Between Little Basses and Hambantotti land and sea breezes prevail with occasional squalls of wind and rain, but the weather is generally fine and clear. There is very little current about the first part of the month, but it runs to the W.S.W. $\frac{1}{2}$ knot at the end of the month.
Between Hambantotti and Galle.	No current		Moderate	S.W.	Moderate	First part moderate westerly winds and fine weather, hazy over the land. Latter part the weather gets cloudy with squalls and rain at times. The heavy S.W. swell still continues.
Between Galle and Colombo.	No current		Moderate	W.S.W.	Moderate	In the first part the weather is fine and the wind from S.W. to N.W. and W.S.W. with hazy weather. In the latter part the weather is very unsettled, sometimes very heavy squalls of wind and rain from S.W. The heavy S.W. swell continues this month, the currents are light and variable.

MONTHLY STATEMENT of CURRENTS and WINDS on the COASTS of CEYLON—continued.

NOVEMBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pamban.	Knots per Hour. $\frac{1}{4}$	Northerly	Moderate	N.W. to N.E.	Moderate	The winds and weather are very unsettled, the wind veering W.N.W. to north and N.E., with frequent heavy squalls and rain. Cloudy overcast sky.
Between Pamban and Jafna.	1 to 2	Tidal ebb northerly and flood southerly.	Moderate	Variable	Smooth	The winds and weather are very unsteady and unsettled with cloudy squally weather and frequent heavy falls of rain.
Between Jafna and point Pedro.	1	Tidal ebb to eastward and flood to westward.	Various	Variable	Smooth	The winds and weather are unsteady and unsettled with hard squalls of wind and rain, and when from N.E. the sea rises rapidly; the current out at sea setting to S.S.E. and the flood tide together causes a strong indraft towards Falk bay.
Between point Pedro and Trincomali.	2½	S.S.E.	Fresh	N.E.	High	The same remarks apply to these places, but the wind is more frequently N.E., and sometimes a northerly gale sets in, with a high turbulent sea. The current is as much as 3½ knots at times. It is very cloudy and gloomy over the land.
Between Trincomali and Batticaloa.	2 to 3	S.S.E.	Moderate	N.E.	Moderate	The prevailing winds are from the N.E., but it frequently comes from west and S.W. It is squally with rain during the month and very hazy over the land.
Between Batticaloa and Little Bases.	1½ to 2½	S.S.W.	Light	N.E.	Moderate	The prevailing winds are from the N.E., but there are occasional southerly and westerly winds and cloudy weather. It is squally and rainy unsettled weather during this month.
Between Little Bases and Hambantotti.	1½	W.S.W.	Light	Westerly	Moderate	The prevailing winds are westerly, but it is very unsteady, and variable winds may be expected, also calms with occasional squalls and rain.
Between Hambantotti and Galle.	No current	No current	Moderate	Westerly	Moderate	The winds are variable, and the weather very unsettled, with frequent calms and squalls of wind and rain; it is very hazy at times over the land.
Between Galle and Colombo.	No current	No current	Light	N.E. to W.N.W.	Moderate	Light variable winds mostly from N.E., sometimes very heavy squalls of wind and rain from N.E. to north. The winds and weather are generally unsettled, the current sets slightly to the southward.

MONTHLY STATEMENT of CURRENTS and WINDS on the COASTS of CEYLON—*continued*.
DECEMBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ½ to 1	Southerly	Fresh	N.N.E. to E.N.E.	Moderate	Fresh N.E. and E.N.E. winds prevail; the weather in the first part is generally cloudy and hazy with a few squalls of wind and rain. In the latter part the winds are moderate and the weather much finer.
Between Pambam and Jafna.	Tidal ¼ to ¾	Tidal ebb northerly and flood southerly.	Fresh	North to N.E.	Smooth	The winds are fresh from north to N.E. with squalls and rain the first part of the month, becoming more moderate with finer weather in the latter part. The sea is smooth except the wind is against the tide.
Between Jafna and point Pedro.	Tidal ¼ to ¾	Tidal ebb east and flood west.	Moderate	North to E.N.E.	Moderate	The prevailing winds are from north to E.N.E. and blow fresh with squalls and rain in the early part of the month, but in the latter part fresh breezes but much finer weather; during some days it is very cloudy.
Between point Pedro and Trincomali.	1 to 3	S.S.E.	Fresh	N.E.	High	The same winds and weather in the early part of the month, but more moderate in the latter part; the sea is high and turbulent especially off Muletiyu. In very strong winds the sea is high and turbulent.
Between Trincomali and Batticaloa.	1 to 3	S.S.E.	Moderate	North to N.E.	Moderate	The prevailing winds are from north to N.E. and sometimes a gale occurs from north to N.W. with heavy rain and a very high turbulent sea. In the latter part it is much finer weather. The easterly swell is very bad at Batticaloa anchorage.
Between Batticaloa and Little Basses.	1 to 4	S.S.W.	Fresh	North to N.E.	High	The wind varies from north to north-east and E.N.E. and N.W.; it blows fresh at times in the early part of the month with hard squalls and rain with a high turbulent sea, but the winds and weather are much better towards the end of the month.
Between Little Basses and Hambantotti.	1 to 3	W.S.W.	Fresh	N.N.W. to East.	Moderate	In the first part the winds are fresh, with cloudy weather with occasional squalls and rain. In the latter part is finer but very hazy at times. At Hambantotti the wind is N.E. in the morning and S.E. in the afternoon.
Between Hambantotti and Galle.	½ to 1	W.S.W.	Light	Easterly	Moderate	The prevailing winds are easterly, light in the morning and fresh in the afternoon. Light showers of rain may be expected off Point de Galle with land and sea breezes.
Between Galle and Colombo.	½ to 1	S.S.E.	Light	N.N.W. to N.N.E.	Smooth	Land and sea breezes prevail, also light variable winds and calms with light showers of rain at times. The weather in general is fine and clear with a smooth sea.

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